GE Medical Systems

Technical Publication

Part Number FC091194
Revision 02

GE Medical Systems
Vivid 7 / Vivid 7 PRO Service Manual

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IMPORTANT PRECAUTIONS

LANGUAGE

- **THIS SERVICE MANUAL IS AVAILABLE IN ENGLISH ONLY.**
- **IF A CUSTOMER'S SERVICE PROVIDER REQUIRES A LANGUAGE OTHER THAN ENGLISH, IT IS THE CUSTOMER'S RESPONSIBILITY TO PROVIDE TRANSLATION SERVICES.**

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- **DO NOT ATTEMPT TO SERVICE THE EQUIPMENT UNLESS THIS SERVICE MANUAL HAS BEEN CONSULTED AND IS UNDERSTOOD.**
- **FAILURE TO HEED THIS WARNING MAY RESULT IN INJURY TO THE SERVICE PROVIDER, OPERATOR OR PATIENT FROM ELECTRIC SHOCK, MECHANICAL OR OTHER HAZARDS.**

- **CE MANUEL DE MAINTENANCE N'EST DISPONIBLE QU'EN ANGLAIS.**
- **SI LE TECHNICIEN DU CLIENT A BESOIN DE CE MANUEL DANS UNE AUTRE LANGUE QUE L'ANGLAIS, C'EST AU CLIENT QU'IL INCOMBE DE LE FAIRE TRADUIRE.**

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- **DIESES KUNDENDIENST-HANDBUCH EXISTIERT NUR IN ENGLISCHER SPRACHE.**
- **FALLS EIN FREMDER KUNDENDIENST EINE ANDERE SPRACHE BENÖTIGT, IST ES AUFGABE DES KUNDEN FÜR EINE ENTSPRECHENDE ÜBERSETZUNG ZU SORGEN.**

WARNUNG

- **VERSUCHEN SIE NICHT, DAS GERÄT ZU REPARIEREN, BEVOR DIESES KUNDENDIENST-HANDBUCH NICHT ZU RATE GEZOGEN UND VERSTANDEN WURDE.**
- **WIRD DIESE WARNUNG NICHT BEACHTET, SO KANN ES ZU VERLETZUNGEN DES KUNDENDIENSTTECHNIKERS, DES BEDIENERS ODER DES PATIENTEN DURCH ELEKTRISCHE SCHLÄGE, MECHANISCHE ODER SONSTIGE GEFAHREN KOMMEN.**

AVISO

- **ESTE MANUAL DE SERVICIO SÓLO EXISTE EN INGLÉS.**
- **SI ALGÚN PROVEEDOR DE SERVICIOS AJENO A GEMS SOLICITA UN IDIOMA QUE NO SEA EL INGLÉS, ES RESPONSABILIDAD DEL CLIENTE OFRECER UN SERVICIO DE TRADUCCIÓN.**
- **NO SE DEBERÁ DAR SERVICIO TÉCNICO AL EQUIPO, SIN HABER CONSULTADO Y COMPRENDIDO ESTE MANUAL DE SERVICIO.**
- **LA NO OBSERVANCIA DEL PRESENTE AVISO PUEDE DAR LUGAR A QUE EL PROVEEDOR DE SERVICIOS, EL OPERADOR O EL PACIENTE SUFRAN LESIONES PROVOCADAS POR CAUSAS ELÉCTRICAS, MECÁNICAS O DE OTRA NATURALEZA.**

ATENÇÃO

- **ESTE MANUAL DE ASSISTÊNCIA TÉCNICA SÓ SE ENCONTRA DISPONÍVEL EM INGLÊS.**
- **SE QUALQUER OUTRO SERVIÇO DE ASSISTÊNCIA TÉCNICA, QUE NÃO A GEMS, SOLICITAR ESTES MANUAIS NOUTRO IDIOMA, É DA RESPONSABILIDADE DO CLIENTE FORNECER OS SERVIÇOS DE TRADUÇÃO.**
- **NÃO TENTE REPARAR O EQUIPAMENTO SEM TER CONSULTADO E COMPREENDIDO ESTE MANUAL DE ASSISTÊNCIA TÉCNICA.**
- **O NÃO CUMPRIMENTO DESTE AVISO PODE POR EM PERIGO A SEGURANÇA DO TÉCNICO, OPERADOR OU PACIENTE DEVIDO A‘ CHOQUES ELÉTRICOS, MECÂNICOS OU OUTROS.**

AVVERTENZA

- **IL PRESENTE MANUALE DI MANUTENZIONE È DISPONIBILE SOLTANTO IN INGLESE.**
- **SE UN ADDETTO ALLA MANUTENZIONE ESTERNO ALLA GEMS RICHIEDE IL MANUALE IN UNA LINGUA DIVERSA, IL CLIENTE È TENUTO A PROVVEDERE DIRETTAMENTE ALLA TRADUZIONE.**
- **SI PROCEDA ALLA MANUTENZIONE DELL’APPARECCHIATURA SOLO DOPO AVER CONSULTATO IL PRESENTE MANUALE ED AVERNE COMPRESO IL CONTENUTO.**
- **NON TENERE CONTO DELLA PRESENTE AVVERTENZA POTREBBE FAR COMPIERE OPERAZIONI DA CUI DERIVINO LESIONI ALL’ADDETTO ALLA MANUTENZIONE, ALL’UTILIZZATORE ED AL PAZIENTE PER FOLGORAZIONE ELETTRICA, PER URTI MECCANICI OD ALTRI RISCHI.**

このサービスマニュアルには英語版しかありません。
ＧＥＭＳ以外でサービスを担当される業者が英語以外の言語を要求される場合、翻訳作業はその業者の責任で行うものとさせていただきます。

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Complete instructions regarding claim procedure are found in Section S of the Policy And Procedures Bulletins.

14 July 1993

CERTIFIED ELECTRICAL CONTRACTOR STATEMENT

(For USA Only)

All electrical Installations that are preliminary to positioning of the equipment at the site prepared for the equipment shall be performed by licensed electrical contractors. Other connections between pieces of electrical equipment, calibrations and testing shall be performed by qualified GE Medical personnel. In performing all electrical work on these products, GE will use its own specially trained field engineers. All of GE's electrical work on these products will comply with the requirements of the applicable electrical codes.

The purchaser of GE equipment shall only utilize qualified personnel (i.e., GE's field engineers, personnel of third-party service companies with equivalent training, or licensed electricians) to perform electrical servicing on the equipment.

OMISSIONS & ERRORS

If there are any omissions, errors or suggestions for improving this documentation, please contact the GE Medical Systems Global Documentation Group with specific information listing the system type, manual title, part number, revision number, page number and suggestion details. E-mail the information to : **UltrasoundDocError@med.ge.com**

GE Medical Systems employees should use the Customer Quality Assurance (CQA) System to report all documentation omissions, errors or suggestions.

Revision History

REVISION	DATE	REASON FOR CHANGE
01	11. JUN. 2002	Covers both Vivid 7 and Vivid 7 PRO Replaces Vivid 7 Service Manual, Part Number FB091202
02	30. AUG. 2002	Updated per BT02-M4 release. Included description for BEP-2.

List of Effected Pages

Pages	Revision	Pages	Revision	Pages	Revision
Title Page	02	4-1 to 4-66	02	9-1 to 9-37	02
Warnings iii to vi	02	5-1 to 5-104	02	10-1 to 10-26	02
Rev History/LOEP vii to viii	02	6-1 to 6-8	02	Back Cover	N/A
1-1 to 1-40	02	7-1 to 7-70	02		
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Chapter 1
Introduction

Section 1-1
Overview

1-1-1 Purpose of Chapter 1

This chapter describes important issues related to safely servicing this ultrasound machine. The service provider must read and understand all the information presented here before installing or servicing a unit.

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1-1-2 Purpose of Service Manual

This Service Manual provides installation and service information for the Vivid 7 / Vivid 7 PRO Ultrasound Scanning unit and contains the following chapters:

1.) Chapter 1 - **Introduction:** Contains a content summary and warnings.
2.) Chapter 2 - **Pre-Installation:** Contains any pre-installation requirements for the Vivid 7 / Vivid 7 PRO.
3.) Chapter 3 - **Installation:** Contains installation procedure with installation checklist.
4.) Chapter 4 - **Functional Checks:** Contains functional checks that must be performed as part of the installation, or as required during servicing and periodic maintenance.
5.) Chapter 5 - **Components and Functions (Theory)**: Contains block diagrams and functional explanations of the electronics.
6.) Chapter 6 - **Service Adjustments:** Contains instructions on how to make any available adjustments to the Vivid 7 / Vivid 7 PRO.
7.) Chapter 7 - **Diagnostics/Troubleshooting:** Provides procedures for running and diagnostic or related routines for the Vivid 7 / Vivid 7 PRO.
8.) Chapter 8 - **Replacement Procedures:** Provides disassembly procedures and reassembly procedures for all changeable FRU.
9.) Chapter 9 - **Renewal Parts:** Contains a complete list of replacement parts for Vivid 7 / Vivid 7 PRO.
10.) Chapter 10 - **Periodic Maintenance:** Provides periodic maintenance procedures for Vivid 7 / Vivid 7 PRO.

1-1-3 Typical Users of the Service Manual

- Service Personnel (installation, maintenance, etc.).
- Hospital's Service Personnel
- Architectural Planners/Installation Planners (some parts of Chapter 2, Pre-Installation)

1-1-4 Vivid 7 / Vivid 7 PRO Models Covered by this Manual

Table 1-2 Vivid 7 / Vivid 7 PRO Models Covered in this Manual

GE VINGMED PART NUMBER	DESCRIPTION	VOLTAGE
FB000030	VIVID 7 (BT '01)	230 VAC
FC000060	VIVID 7 (BT '01)	100 - 120 VAC
FC000180	VIVID 7 PRO (BT '02)	220 - 240 VAC
FC000190	VIVID 7 PRO (BT '02)	100 - 120 VAC
FC000200	VIVID 7 (BT '02)	220 - 240 VAC
FC000210	VIVID 7 (BT '02)	100 - 120 VAC

1-1-4-1 Overview

- Vivid 7 / Vivid 7 PRO is a phased and linear array ultrasound imaging scanner. It also has provisions for analog input sources like ECG and phono, and a Doppler probe may be connected and used too.
- The unit can be used for:
  - 2D Black and White imaging
  - 2D Color Flow
  - M-Mode Black and White imaging
  - Color M-Mode
  - Doppler
  - a number of combinations of the above
- Vivid 7 / Vivid 7 PRO is a digital beam forming unit and can handle up to 192 element linear probes by use of multiplexing.
- Signal flow from the Probe Connector Panel to the Front End, then to the Mid Processors and Backend Processor and finally to the monitor and peripherals.
- System configuration is stored on a hard disk and all necessary software is loaded from the hard disk on power up.

1-1-4-1 Overview (cont'd)

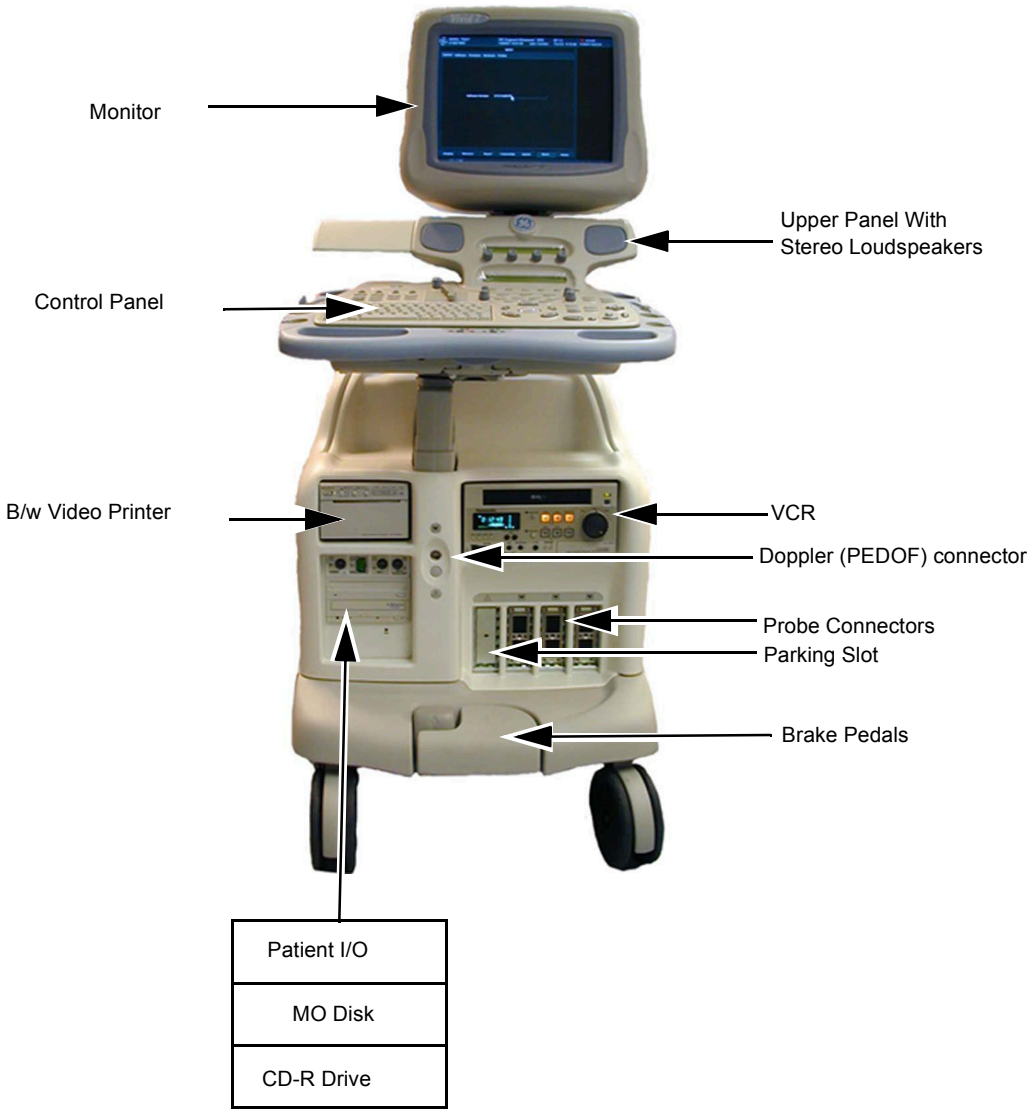


Figure 1-1 Vivid 7 / Vivid 7 PRO Major Components

1-1-4-2 History - Hardware/Software Versions

Use Table 1-3 to verify the correct/needed revision on each card in the Card Rack.

Table 1-3 Required Revisions for Cards and Modules

Card Rack								
		BT'01 (sw. 1.0)		BT'01 (sw. 1.0 / 1.1 / 1.2)		BT'02 (sw. 2.0 / 2.1)		
Part Number	Name	Func. Rev.	MCD	Func. Rev.	MCD	Func. Rev.	MCD	Comments
FA200985	Motherboard	-	02	-	02	-	02	
FB200060	RLY-3	05	06	05	06	05	06	MCD rev. 07 includes a noisefix for use of PAMPTE probe.
FB200170	TX128-2.	A	B	A	B	A	B	For Vivid 7 produced before June 3, 2002 and for Vivid 7 PRO
FC200022	TX128-3	-	-	-	-	01	01	Replacement for FB200170 used on Vivid 7 produced after June 3, 2002
FB200831	RX128-3B	01	A	01	A,B	01	A,B	
FB200158	XDBUS-2	-	02	-	02	-	02	2x used
FB200900	BF64	-	B	-	C	-	C/D/E	2x used
FB200165	FEC-II	-	03	-	03, 04	-	03, 04	
FB200140	RFT1	F	B,C	F	B,C	F	B, C, D	Both MCD rev. B, C and D may be used.
FB200865	SDP	01	02	01	02	01	02	
FB200991	IMP-2B	A	A	A	A,B	A	A,B	
FA200945	Power, DC	-	02	-	02	-	02	
FB200574	Power, TX (TXPS)	-	03	-	03	-	03	
FB200724	AC Controller	-	06	-	06/07	-	08	Covers both 100-120 VAC and 220-240 VAC
FC200079	AC Power 100-120V	-	01	-	01	-	01	AC Power supply for 100-120 VAC Used as replacement for AC Controller, FB200724 on 100-120 VAC units
FC200081	AC Power 220-240V	-	01	-	01	-	01	AC Power supply for 220-240 VAC Used as replacement for AC Controller, FB200724 on 220-240 VAC units.
FB200198	External I/O Complete	08	08	08, 09, 10	08, 09, 10	08, 09, 10	08, 09, 10	
FB200197	Internal I/O Board Complete	05	06	05	06	05	06	

1-1-4-2 History - Hardware/Software Versions (cont'd)

Table 1-4 Required Revisions for Cards and Modules

Backend Rack								
		BT'01 (sw. 1.0)		BT'01 (sw. 1.0 / 1.1 / 1.2)		BT'02 (sw. 2.0 / 2.1)		
Part Number	Name	Func. Rev.	MCD	Func. Rev.	MCD	Func. Rev.	MCD	Comments
BACKEND PROCESSOR Used in Production Before September 2002								
FB200480	BACKEND PROCESSOR	-	02	-	02	-	02	
FA200801	PATIENT I/O MODULE II (COMPL)	-	E	-	E	-	E	MCD revision F, G, H or I may also be used
2266548-5	Battery For Backend Processor UPS	-	N/A	-	N/A	-	N/A	
BACKEND PROCESSOR - II Used in Production After September 2002								
2348186	BACKEND PROCESSOR-II WITHOUT MO DRIVE	-	-	-	-	-	-	
2348186-20	POWER SUPPLY	-	-	-	-	-	-	
2348186-21	CD RW DRIVE	-	-	-	-	-	-	
2348186-22	PATIENT IO MODULE	-	-	-	-	-	-	Same as FA200801(?)
2348186-24	MOD DRIVE 9.0G CAPACITY SCSI	-	-	-	-	-	-	
2348186-25	FAN	-	-	-	-	-	-	

1-1-4-3 History - Supported Probes

Table 1-5 Supported Probes and SW Versions

PROBES	PART NUMBER	NAME	SUPPORTED MODELS & SW VERSION		
			BT-01, V7	BT-02, V7	BT-02, V7 PRO
Sector					
3S (Probe, Sector 3S)	2252157	3S PROBE, L500	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
3S, Comfort Scan Probe	2323337	3S COMFORTSCAN PROBE	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
M3s (Probe, AMA Sector M3s)	2295649	2295649 M3S AMA SECT.	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	----------
5S (Probe, Sector 5S)	2290751	5S SECTOR TRANSDUCER	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
7S (Probe, Sector 7S)	2263669	7S PROBE	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
10S (Probe, Sector 10S)	2298589	10 S SECTOR TRANSDUCER	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
PAMPTE					
6T (Probe, TEE 6T)	KN100022	KN100022 6T TEE PROBE	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
8T (Probe, TEE 8T)	KN100023	KN100023 8T PED.TEE PROBE	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
Linear & Convex & Others					
7L (Probe, Linear 7L)	2294521	7L PROBE TYPE (EXP)	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
10L (Probe, Linear 10L)	2294523	10L PROBE TYPE (EXP)	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
12L (Probe, Linear 12L)	2295377	12L PROBE TYPE (EXP)	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
M12L	2294511	M12L MIH PROBE	----------	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
3.5 C (Probe, Convex 3C)	2296158	3.5C CONVEX TRANSDUCER	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
5C (Probe, Convex 5C)	2294516	5C PROBE TYPE (EXP)	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
i13L	KW100011	KW011 I13L INTRAOP.PROBE	----------	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
E8C	2294641	E8C PROBE	----------	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
Pencil					
P2D Pencil Probe	TE100024	TE100024 PENCIL PROBE 2D	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
P6D Pencil Probe	TQ100002	TQ100002 PENCIL PROBE 6D	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x

1-1-4-4 How to Turn the Scanner ON and OFF

Please refer to *Chapter 4*, section 4-2-1 - Power ON/ Boot Up, for a detailed description of how to turn the scanner ON and to *Chapter 4*, section 4-2-2 - Power Shut Down for a detailed description of how to turn the scanner OFF.

1-1-4-5 How to Check for Hardware/Software Version, Installed Options

- Please refer to "History - Hardware/Software Versions" on page 1-4 to check the hardware versions on the boards
- Please refer to "Software Configuration Checks" on page 4-63 to check the software versions on local software on the boards.
- Please refer to "Functional Checks" on page 4-14 to check for installed options.

1-1-5 Purpose of Operator Manual(s)

The Operator Manual(s) should be fully read and understood before operating the Vivid 7 / Vivid 7 PRO and also kept near the unit for quick reference.

Section 1-2
Important Conventions

1-2-1 Conventions Used in Book

1-2-1-1 Model Designations.

This manual covers the Vivid 7 / Vivid 7 PRO scanners listed in Table 1-2.

1-2-1-2 Icons.

Pictures, or icons, are used wherever they will reinforce the printed message. The icons, labels and conventions used on the product and in the service information are described in this chapter.

1-2-1-3 Safety Precaution Messages.

Various levels of safety precaution messages may be found on the equipment and in the service information. The different levels of concern are identified by a flag word that precedes the precautionary message. Known or potential hazards are labeled in one of three ways:

DANGER **Danger is used to indicate the presence of a hazard that will cause severe personal injury or death if the instructions are ignored.**

WARNING ***Warning is used to indicate the presence of a hazard that can cause severe personal injury and property damage if instructions are ignored.***

CAUTION **Caution is used to indicate the presence of a hazard that will or can cause minor personal injury and property damage if instructions are ignored. Equipment Damage Possible.**

NOTICE Notice is used when a hazard is present that can cause property damage but has absolutely no personal injury risk.

Example: Disk drive will crash.

NOTE: *Notes are used to provide important information about an item or a procedure.*

Be sure to read the notes; the information contained in a note can often save you time or effort.

1-2-2 Standard Hazard Icons

Important information will always be preceded by the exclamation point ⚠ contained within a triangle, as seen throughout this chapter. In addition to text, several different graphical icons (symbols) may be used to make you aware of specific types of hazards that could possibly cause harm.

Table 1-6 Standard Hazard Icons

ELECTRICAL	MECHANICAL	RADIATION
		
LASER	**HEAT**	**PINCH**
		

Some others make you aware of specific procedures that should be followed.

Table 1-7 Standard Icons that indicates that a special procedure is to be used

AVOID STATIC ELECTRICITY	TAG AND LOCK OUT	WEAR EYE PROTECTION
		

1-2-3 Product Icons

The following table describes the purpose and location of safety labels and other important information provided on the equipment.

Table 1-8 Product Icons

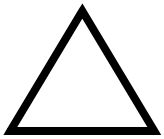
LABEL/SYMBOL	PURPOSE/MEANING	LOCATION
Identification and Rating Plate	Manufacturer's name and address Date of manufacture Model and serial numbers Electrical ratings	Rear of console near power inlet
Type/Class Label	Used to indicate the degree of safety or protection.	
IP Code (IPX8/IP68)	Indicates the degree of protection provided by the enclosure per IEC 529. IPX8 indicates drip proof and may be used in an Operating Theater. The footswitch delivered with Vivid 7 / Vivid 7 PRO is IP68 rated.	Footswitch
	Equipment Type BF (man in the box symbol) IEC 878-02-03 indicates B Type equipment having a floating applied part.	Probe connectors including Doppler probe connector
	Equipment Type CF (heart in the box symbol) IEC 878-02-05 indicates equipment having a floating applied part having a degree of protection suitable for direct cardiac contact.	ECG connector and surgical probes
Device Listing/Certification Labels	Laboratory logo or labels denoting conformance with industry safety standards such as UL or IEC.	Rear of console
CAUTION - This unit weighs...Special care must be used to avoid..." 	This precaution is intended to prevent injury that may result if one person attempt to move the unit considerable distances or on an incline due to the weight of the unit.	On the console where easily seen during transport
"DANGER - Risk of explosion used in..."	The system is not designed for use with flammable anesthetic gases.	Rear of console
	“CAUTION” The equilateral triangle is usually used in combination with other symbols to advise or warn the user.	Various

Table 1-8 Product Icons (continued)

LABEL/SYMBOL	PURPOSE/MEANING	LOCATION
	"ATTENTION - Consult accompanying documents" is intended to alert the user to refer to the operator manual or other instructions when complete information cannot be provided on the label.	Various
	"CAUTION - Dangerous voltage" (the lightning flash with arrowhead in equilateral triangle) is used to indicate electric shock hazards.	Various
	"Mains OFF" Indicates the power off position of the mains power switch.	Rear of system adjacent to mains switch
	"OFF/Standby" Indicates the power off/ standby position of the power switch. **CAUTION** **This Power Switch DOES NOT ISOLATE Mains Supply**	Adjacent to On/Off (Standby) Switch
	"Mains ON" Indicates the Power ON position of the mains power switch. "ON" Indicates the power on position of the power switch. **CAUTION** **The Power Switch on the Front Panel DOES NOT ISOLATE Mains Supply**	
	"Protective Earth" Indicates the protective earth (grounding) terminal.	Used several places inside the scanner.
	"Equipotentiality" Indicates the terminal to be used for connecting equipotential conductors when interconnecting (grounding) with other equipment.	Rear of console

Section 1-3
Safety Considerations

1-3-1 Introduction

The following safety precautions must be observed during all phases of operation, service and repair of this equipment. Failure to comply with these precautions or with specific warnings elsewhere in this manual, violates safety standards of design, manufacture and intended use of the equipment.

1-3-2 Human Safety

Operating personnel must not remove the system covers.

Servicing should be performed by authorized personnel only.

Only personnel who have participated in a Vivid 7 / Vivid 7 PRO Training Seminar are authorized to service the equipment.

1-3-3 Mechanical Safety

⚠ **WARNING** ***WHEN THE UNIT IS RAISED FOR A REPAIR OR MOVED ALONG ANY INCLINE, USE EXTREME CAUTION SINCE IT MAY BECOME UNSTABLE AND TIP OVER.***

⚠ **WARNING** ***ULTRASOUND PROBES ARE HIGHLY SENSITIVE MEDICAL INSTRUMENTS THAT CAN EASILY BE DAMAGED BY IMPROPER HANDLING. USE CARE WHEN HANDLING AND PROTECT FROM DAMAGE WHEN NOT IN USE. DO NOT USE A DAMAGED OR DEFECTIVE PROBE. FAILURE TO FOLLOW THESE PRECAUTIONS CAN RESULT IN SERIOUS INJURY AND EQUIPMENT DAMAGE.***

⚠ **WARNING** ***NEVER USE A PROBE THAT HAS FALLEN TO THE FLOOR. EVEN IF IT LOOKS OK, IT MAY BE DAMAGED.***

⚠ **CAUTION** **Ensure that nobody touch the console arm/frogleg when moving the keyboard console.**

⚠ **CAUTION** **Do not move the unit if the keyboard console is in unlocked position.**

⚠ **CAUTION** **Always lock the Control Console in its parking (locked) position before moving the scanner around.**

⚠ **WARNING** ***WHEN THE TOP CONSOLE IS IN ITS LOCKED POSITION, THE GAS SPRING IS COMPRESSED AND STORES MECHANICAL ENERGY. DURING NORMAL OPERATION THE TOP CONSOLE, THE WEIGHT OF THE MONITOR AND THE MECHANICAL FORCE OF THE GAS SPRING ARE IN BALANCE. TAKE CARE IF/WHEN YOU ACTIVATE THIS GAS SPRING. PERSONAL INJURY CAN OCCUR AFTER THE PANEL IS REMOVED AND THE SPRING PRESSURE IS RELEASED. TAKE CARE WHEN YOU REPAIR THE ELEVATION ASSEMBLY.***

1-3-3 Mechanical Safety (cont'd)

CAUTION **VIVID 7 / VIVID 7 PRO weighs 190 kg (419 lbs) or more, depending on installed peripherals, when ready for use. Care must be used when moving it or replacing its parts. Failure to follow the precautions listed below could result in injury, uncontrolled motion and costly damage.**



CAUTION **Do not transport Vivid 7 / Vivid 7 PRO in a vehicle without locking the casters (wheels).**
ALWAYS:
- Be sure the pathway is clear.
- Use slow, careful motions.
- Use two people when moving on inclines or lifting more than 23 kg (50 lbs).

NOTE: Special care should be taken when transporting the unit in a vehicle:

- Lock keyboard in place.
- Eject Magneto Optical disk from the MO Drive (if installed).
- Eject CD from CD drive.
- Secure the unit in an upright position.
- Lock the casters (wheels) (brake)
- DO NOT use the Control Panel as an anchor point.
- Place the probes in their carrying case.

CAUTION **Keep the heat venting holes on the monitor unobstructed to avoid overheating of the monitor.**

1-3-4 Electrical Safety

1-3-4-1 Safe Practices

Follow these guidelines to minimize shock hazards whenever you are using the scanner;

- The equipment chassis must be connected to an electrical ground.
- The unit is equipped with a three-conductor AC power cable. This must be plugged into an approved electrical outlet with safety ground.
- The power outlet used for this equipment should not be shared with other types of equipment.
- Both the system power cable and the power connector must meet international electrical standards.

1-3-4-2 Probes

Follow these guidelines before connecting a probe to the scanner;

- Inspect the probe prior to each use for damage or degradation to the;
  - housing
  - cable strain relief
  - lens
  - seal
- Do not use a damaged or defective probe.

- Never immerse the probe connector or adapter into any liquid.

1-3-5 Labels Locations

1-3-5-1 Labels on Front of Monitor and Control Panel

Table 1-9 Labels on Front of Monitor and Control Panel

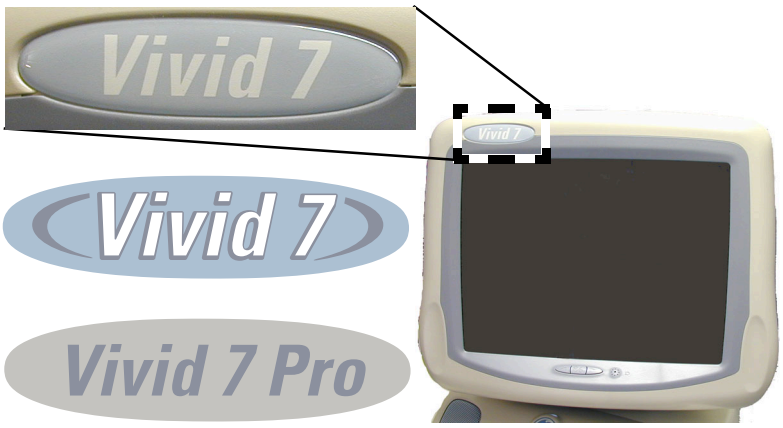
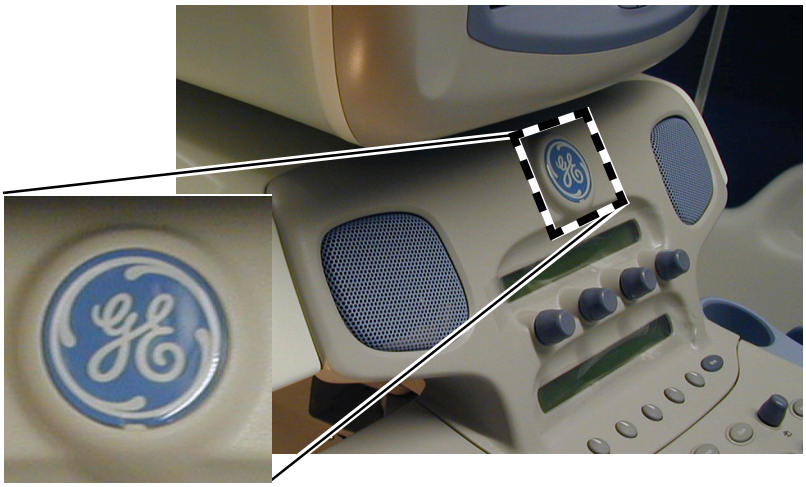
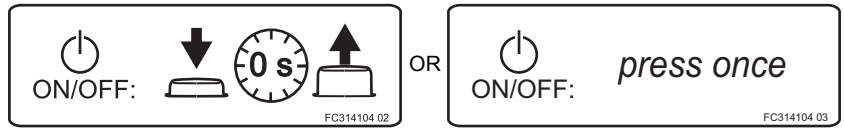
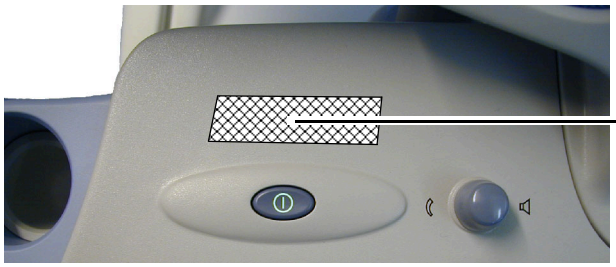
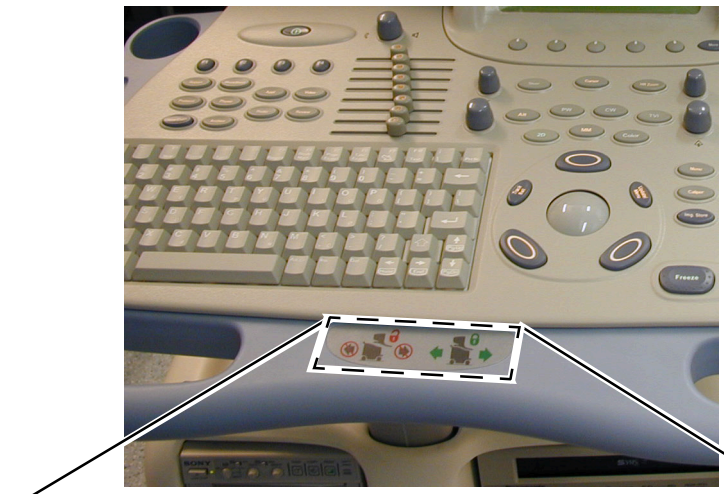
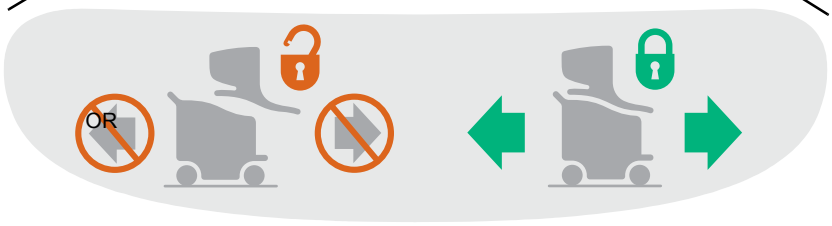
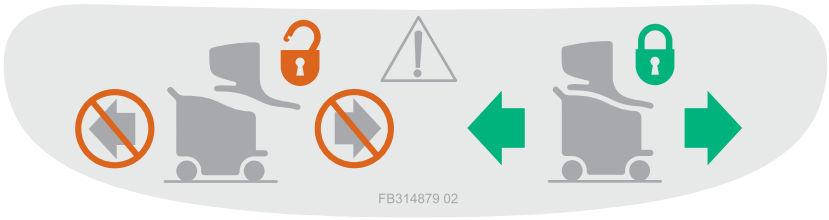
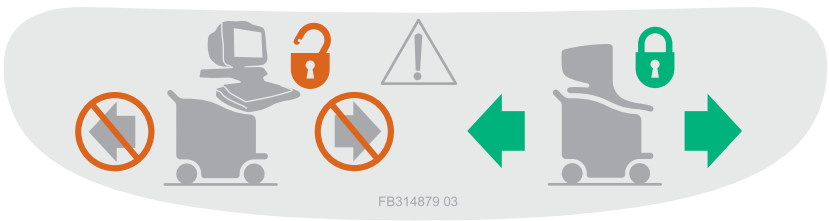
DESCRIPTION	ILLUSTRATION
Label, Vivid 7 (Monitor) - BT'01 Label, Vivid 7 (Monitor) - BT'02 Label, Vivid 7 PRO (Monitor) - BT'02	
Label, GE Logo	

Table 1-9 Labels on Front of Monitor and Control Panel (continued)

DESCRIPTION	ILLUSTRATION
Label, On/Off Switch (Two versions of the label have been used, the one to the right is the latest version.)	 

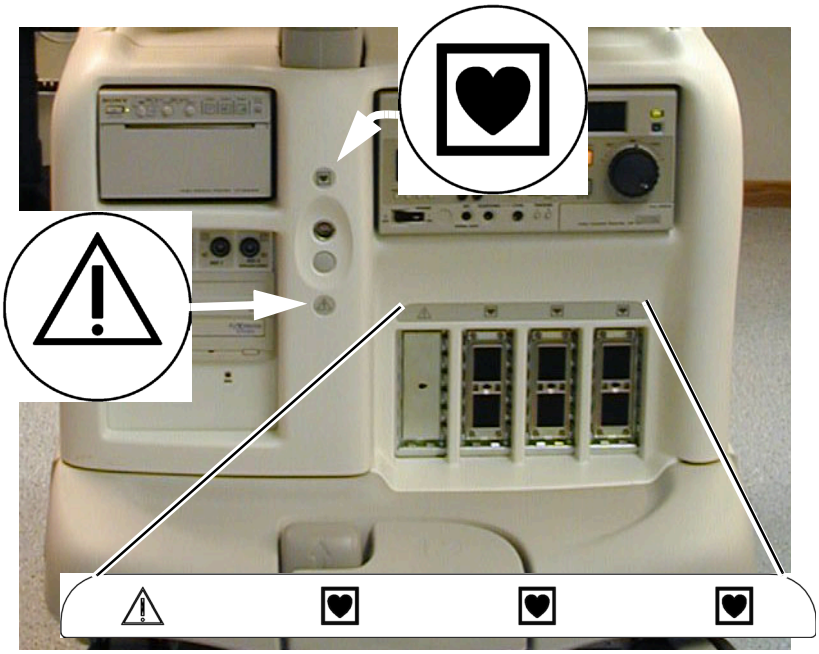
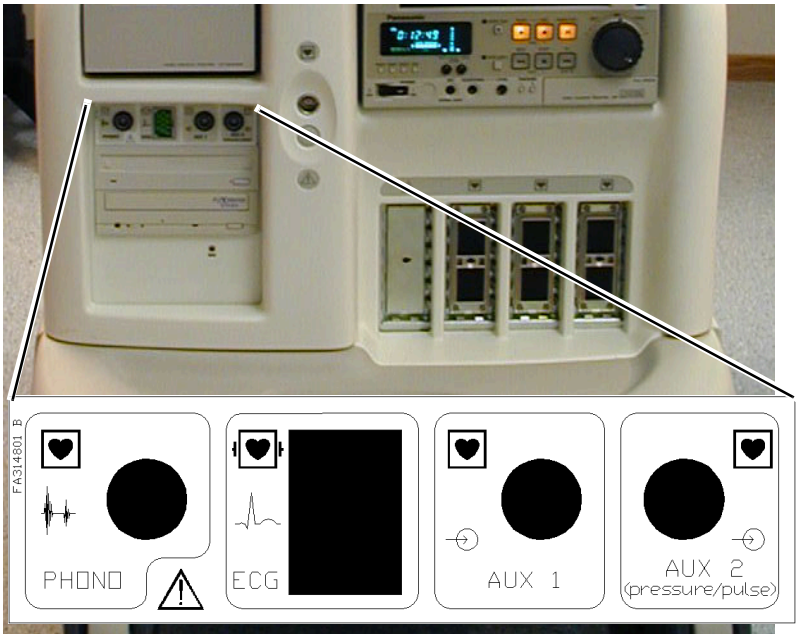
1-3-5-2 Labels on Front Handle

Table 1-10 Labels on Front Handle

DESCRIPTION	ILLUSTRATION
Label, Front Handle (Three versions of the label have been used. The lower one is the latest version)	 OR  OR  FB314879 02 OR  FB314879 03

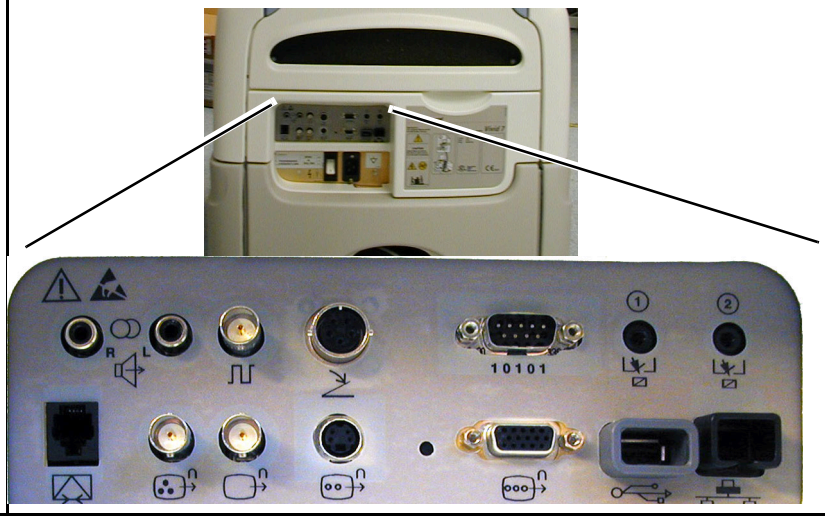
1-3-5-3 Labels Near Connectors on Front

Table 1-11 Labels Near Connectors on Front

DESCRIPTION	ILLUSTRATION
Label, Probe Connector (The Label, “Probe Connector” consists of three labels, named; - “Main Label Part”, - “Heart Symbol” and - “See Manual symbol”.)	
Label, Patient I/O Module II	
Label CD ROM (introduced April 2002)	

1-3-5-4 Label on External I/O

Table 1-12 Label, External I/O

DESCRIPTION	ILLUSTRATION
Label, External. I/O	

1-3-5-5 Labels at AC Mains Inlet and Circuit Breaker

Table 1-13 Labels at AC Mains Inlet and Circuit Breaker (used before May 2002)

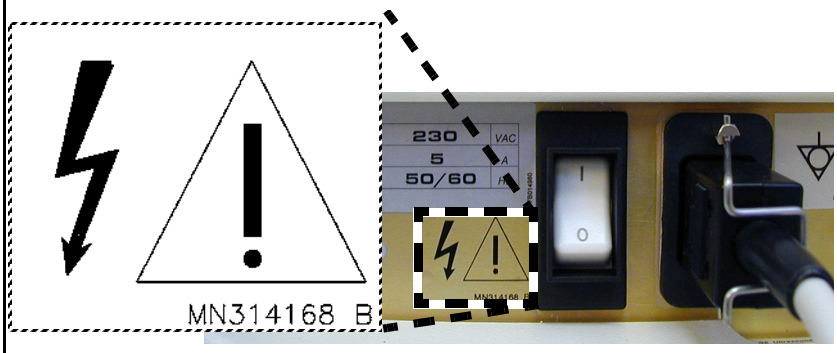
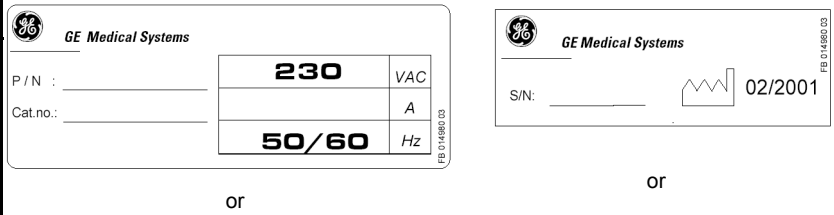
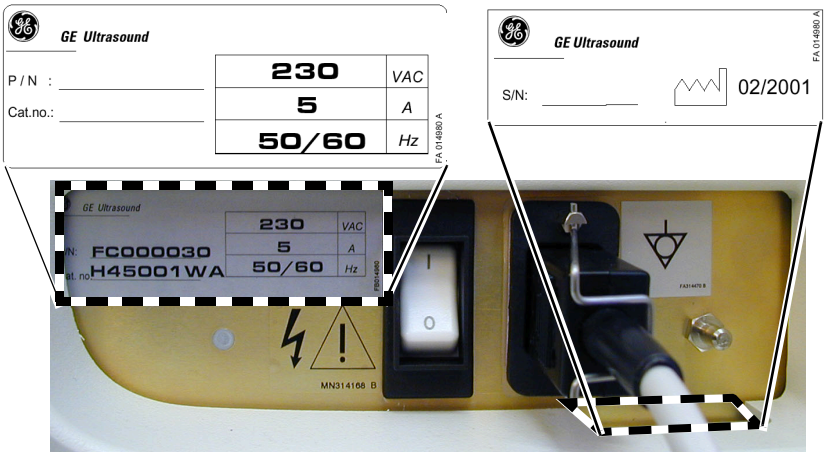
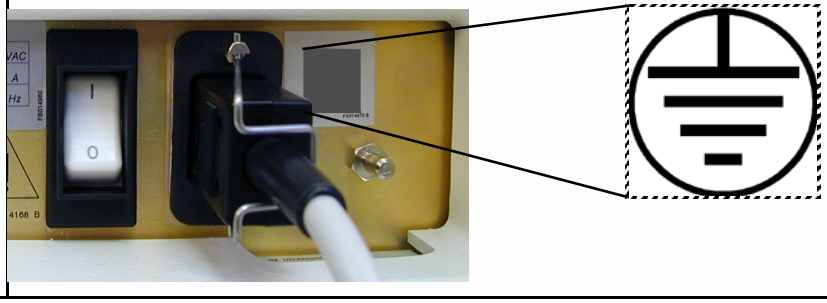
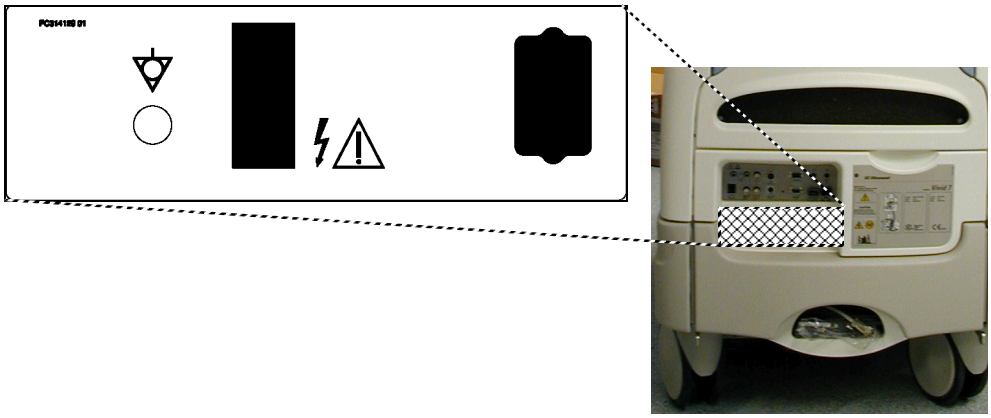
DESCRIPTION	ILLUSTRATION
Label, Warning	
Label, System: P/N, Pwr.rating	 or or
Label, System: S/N	
Label, GND-symbol	Ground (GND) Label. (Used on 230 VAC Systems and some 100-120 VAC Systems.) I 

Table 1-13 Labels at AC Mains Inlet and Circuit Breaker (used before May 2002) (continued)

DESCRIPTION	ILLUSTRATION
Label, GND-symbol., Hospital Grade	 Hospital Grade Ground (GND) Label. (Used on some 100-120 VAC Systems)

Table 1-14 Labels at AC Mains Inlet and Circuit Breaker (used after May 2002)

DESCRIPTION	ILLUSTRATION
Label, AC Controller	

1-3-5-6 Label on Rear Cover

Table 1-15 Label on Rear Cover

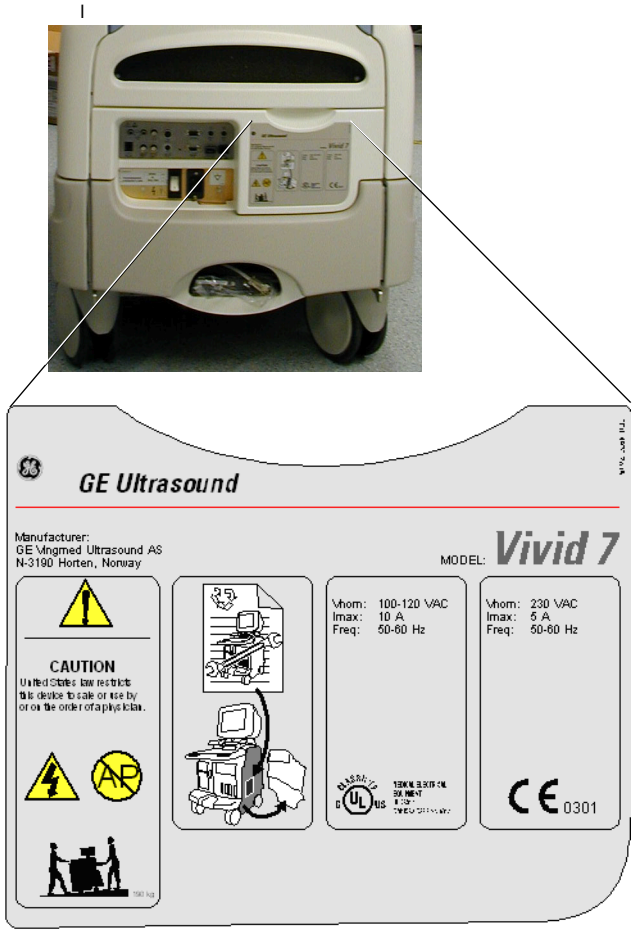
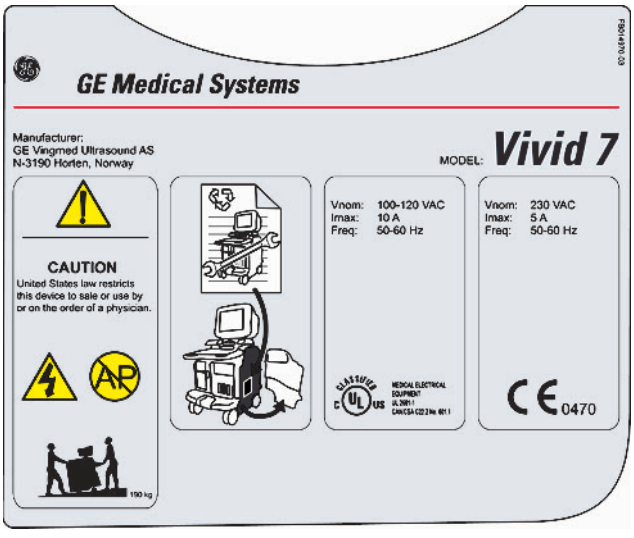
DESCRIPTION	ILLUSTRATION
Label, General Info (Located on rear of system) Label used for Vivid 7 *before* 2 May 2002	
Label, General Info (Located on rear of system) Label used for Vivid 7 *after* 2 May 2002	

Table 1-15 Label on Rear Cover (continued)

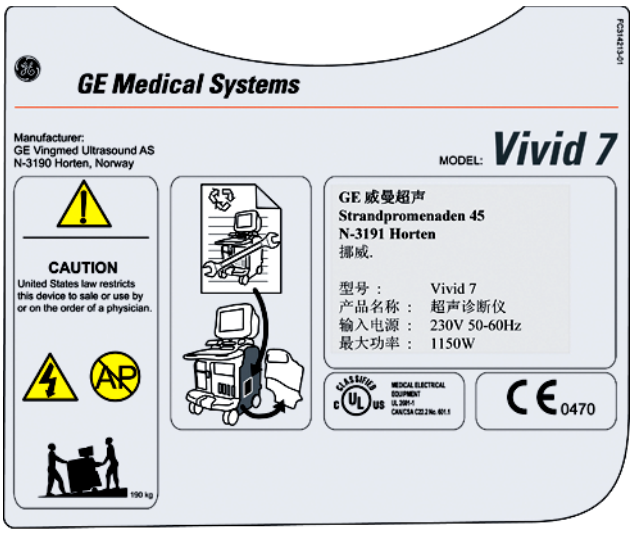
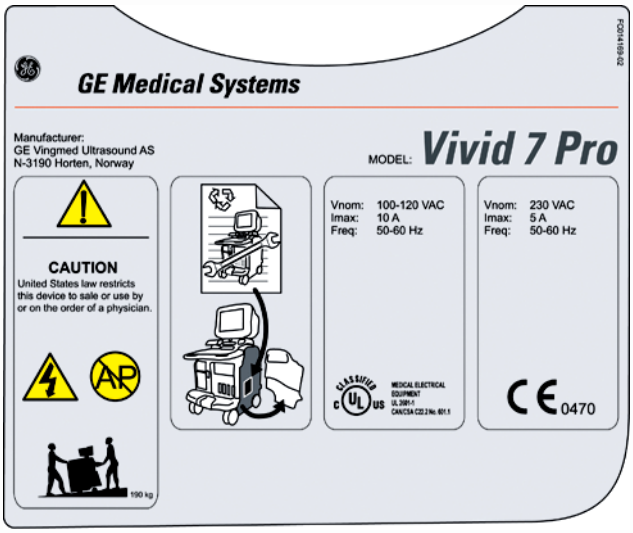
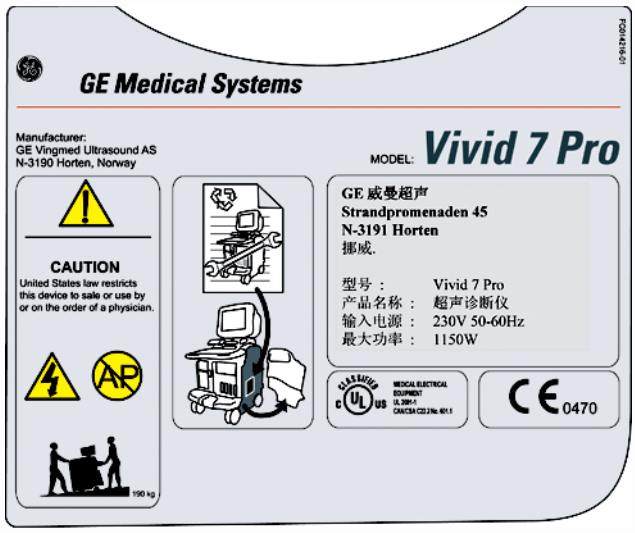
DESCRIPTION	ILLUSTRATION
Label, General Info (Located on rear of system) Label used for Vivid 7 to China	
Label, General Info (Located on rear of system) Label used for Vivid 7 PRO	

Table 1-15 Label on Rear Cover (continued)

DESCRIPTION	ILLUSTRATION
Label, General Info (Located on rear of system) Label used for Vivid 7 PRO to China	

1-3-5-7 Labels on Internal I/O (Inside Scanner)

Label on Front End Card Cage Side of Internal I/O

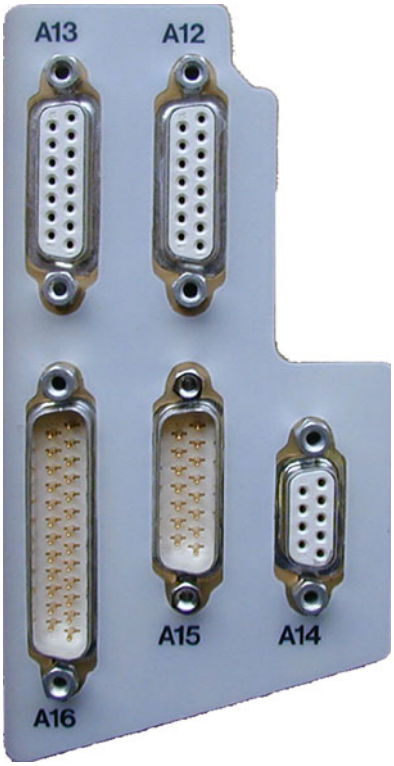


Figure 1-2 Labels on Internal I/O (Inside Scanner), Front End Card Cage Side of Internal I/O

1-3-5-8 Labels on Internal I/O (Inside Scanner)

Label on Backend Processor Side of Internal I/O

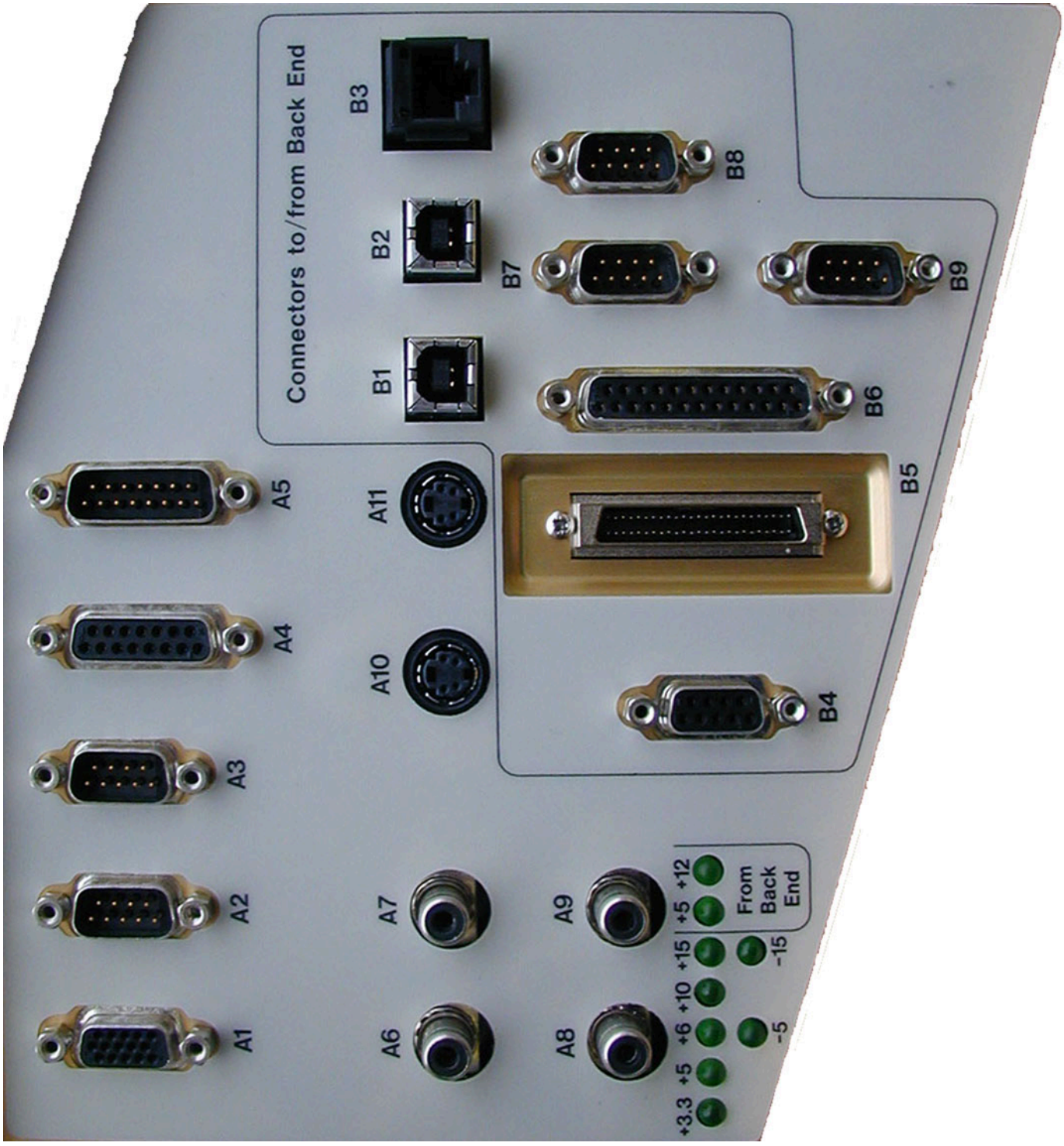


Figure 1-3 Labels on Internal I/O (Inside Scanner), Backend Processor Side of Internal I/O

1-3-5-9 Label, Internal Connections (Int.Conn.) - Part 1, Left Part of Label

Located on the outside of the Front End Card Rack's cover (inside unit).Different versions of the label has been used since production start. The label shown here, is the latest version.

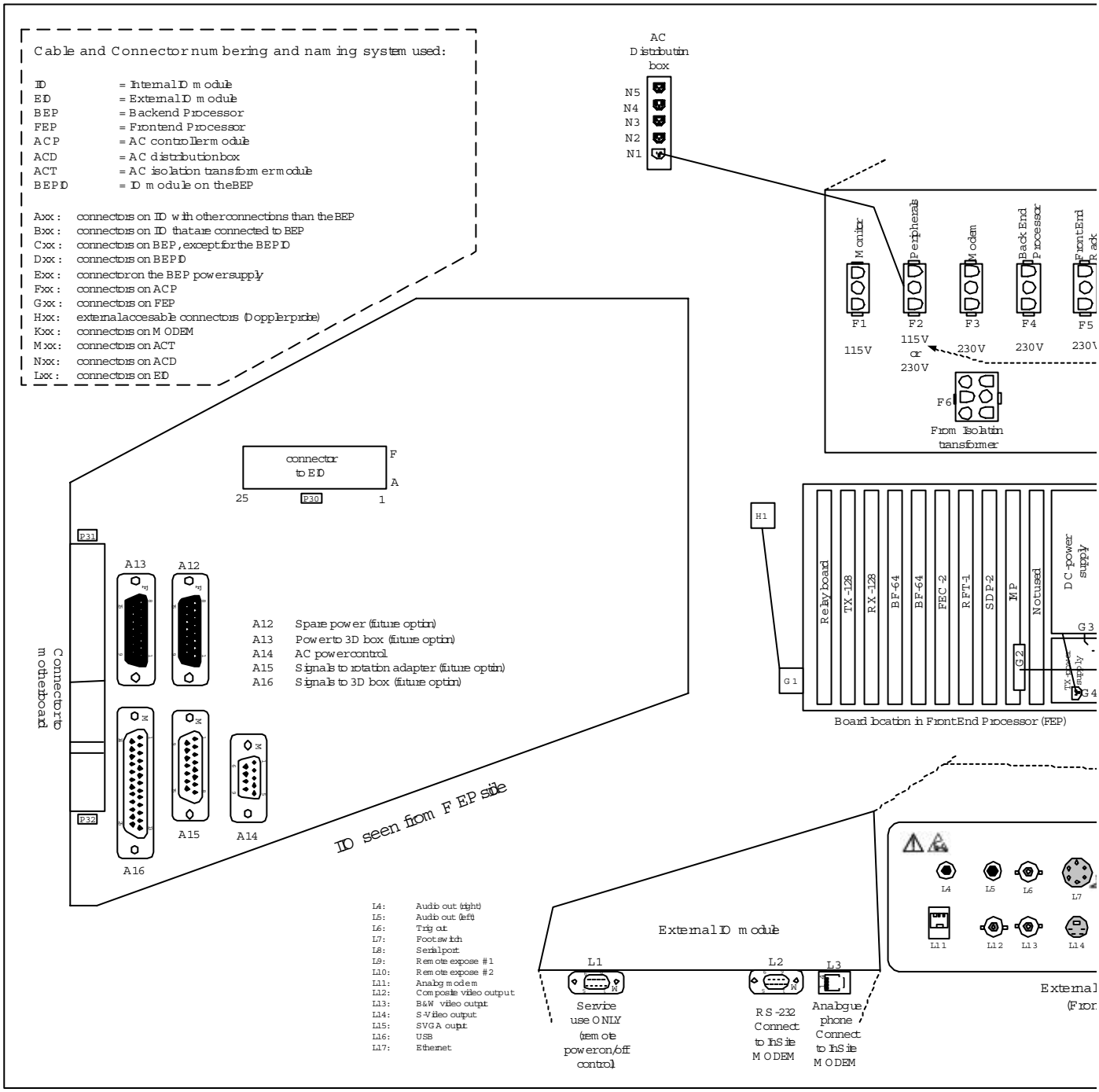


Figure 1-4 Label, Internal Connections - Part 1, Left Part of Label

1-3-5-10 Label, Internal Connections (Int.Conn.) - Part 2, Right Part of Label

Located on the outside of the Front End Card Rack's cover (inside unit). Different versions of the label has been used since production start. The label shown here, is the latest version.

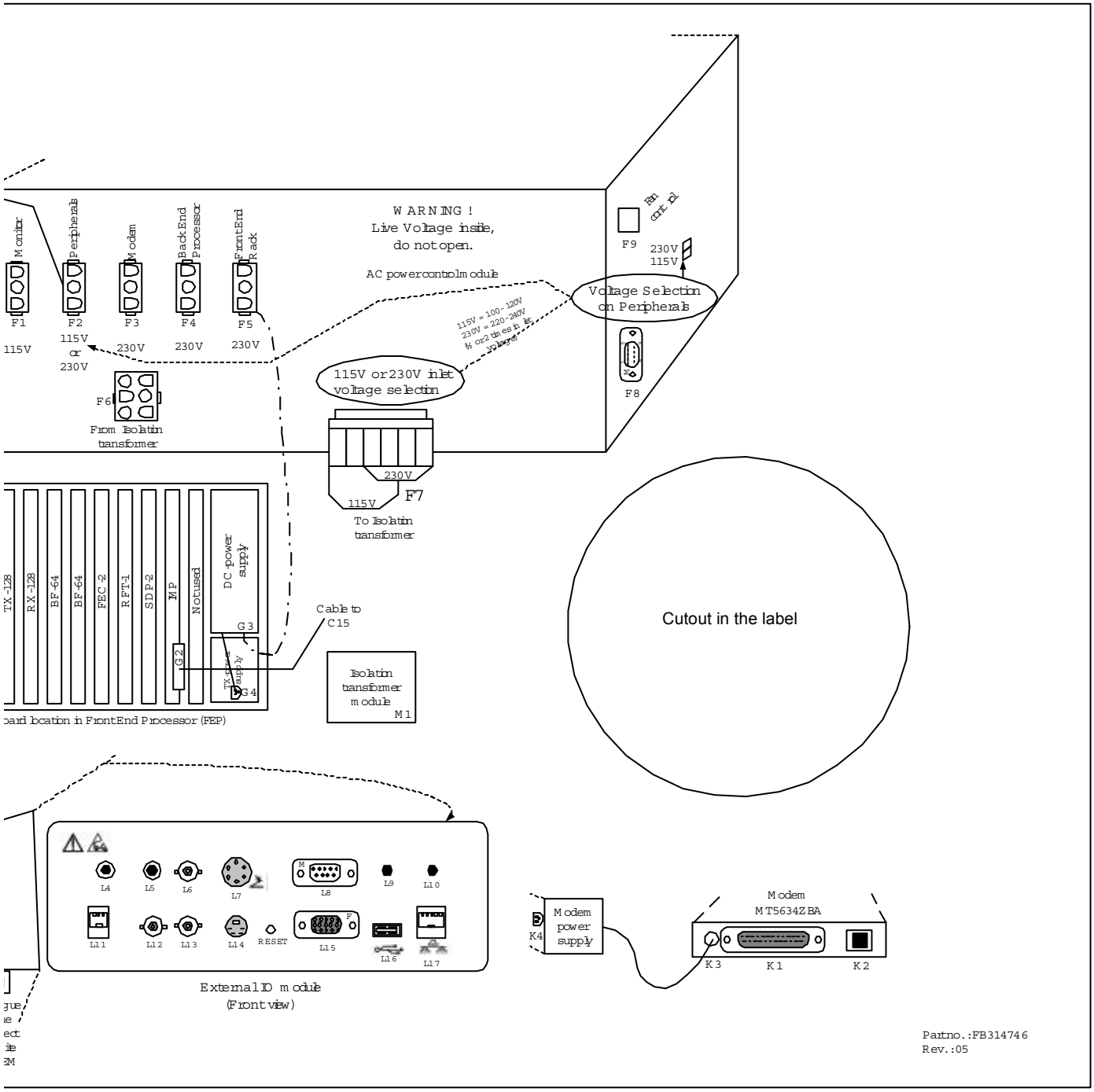


Figure 1-5 Label, Internal Connections - Part 1, Right Part of Label

1-3-5-11 Label, Internal Connections (Int.Conn.) - Upper Part

Located on the outside of the Backend Processor's Cover (inside unit)

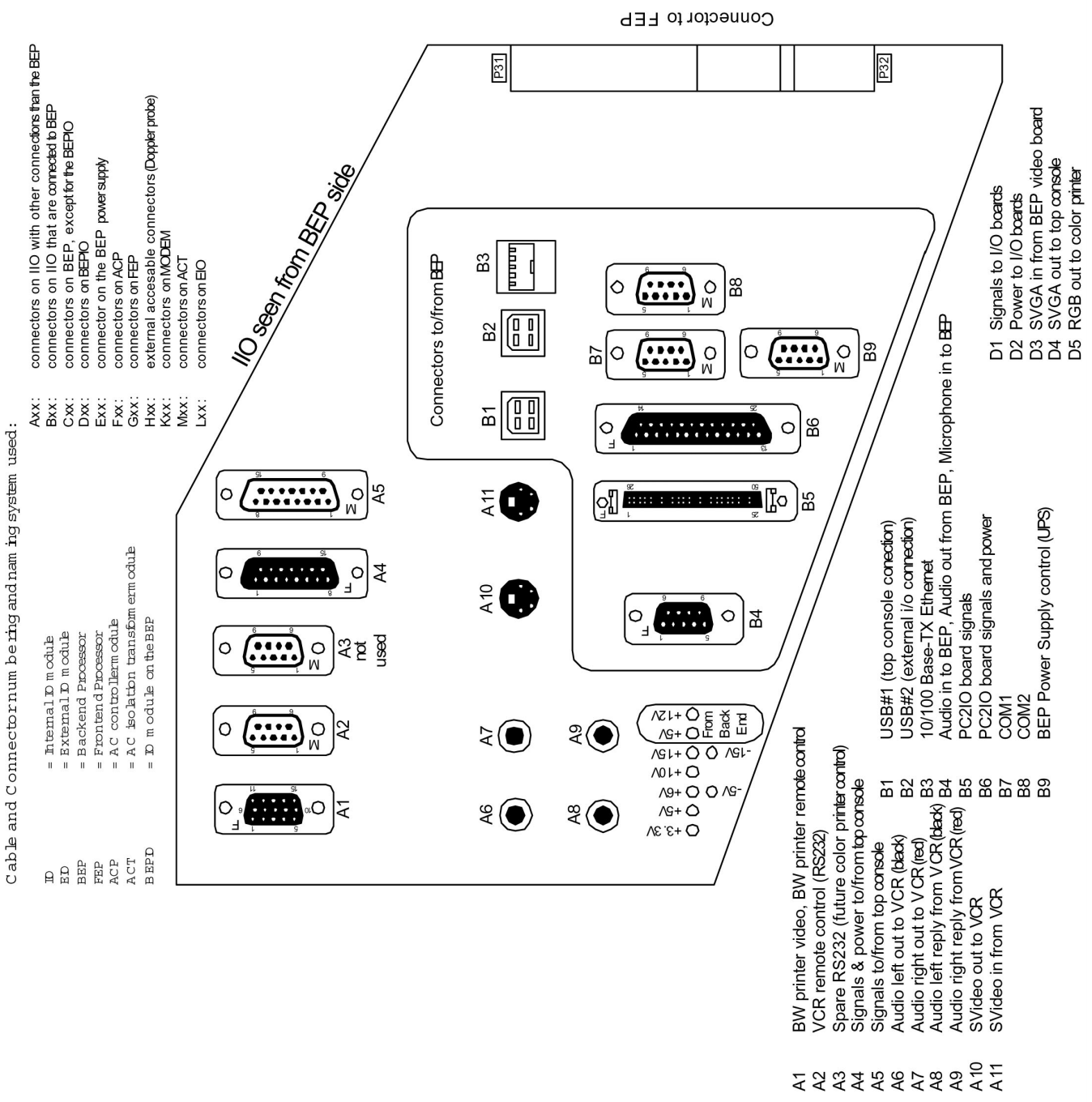


Figure 1-6 Label, Internal Connections (Int.Conn.), Upper Part

1-3-5-12 Label, Internal Connections (Int.Conn.) - Lower Part

Located on the outside of the Backend Processor's Cover (inside unit)

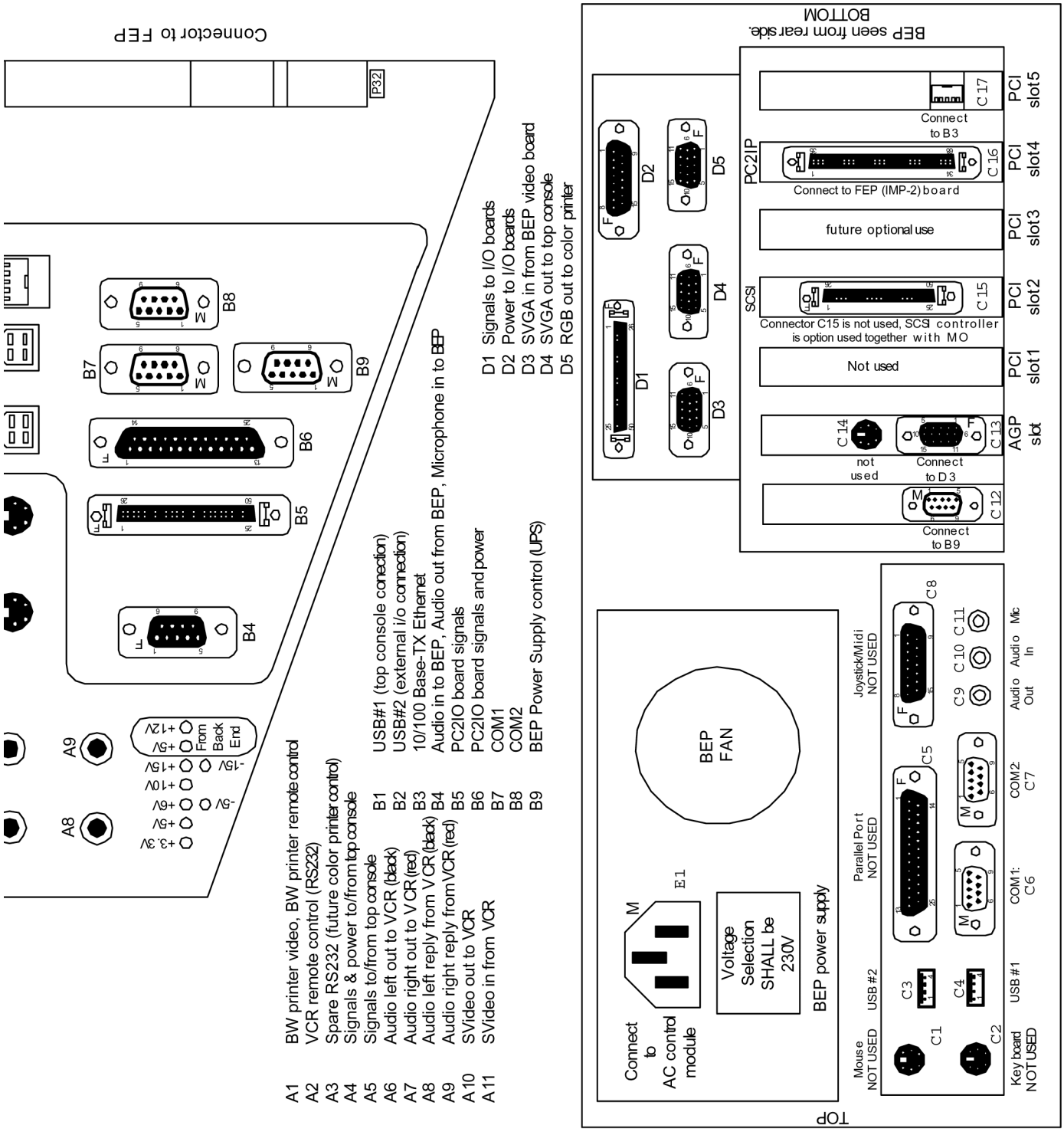


Figure 1-7 Label, Internal Connections (Int.Conn.) - Lower Part

1-3-5-13 Label, Internal Connections (Int.Conn.) - Upper Part

Located on the outside of the Backend Processor's Cover (inside unit)

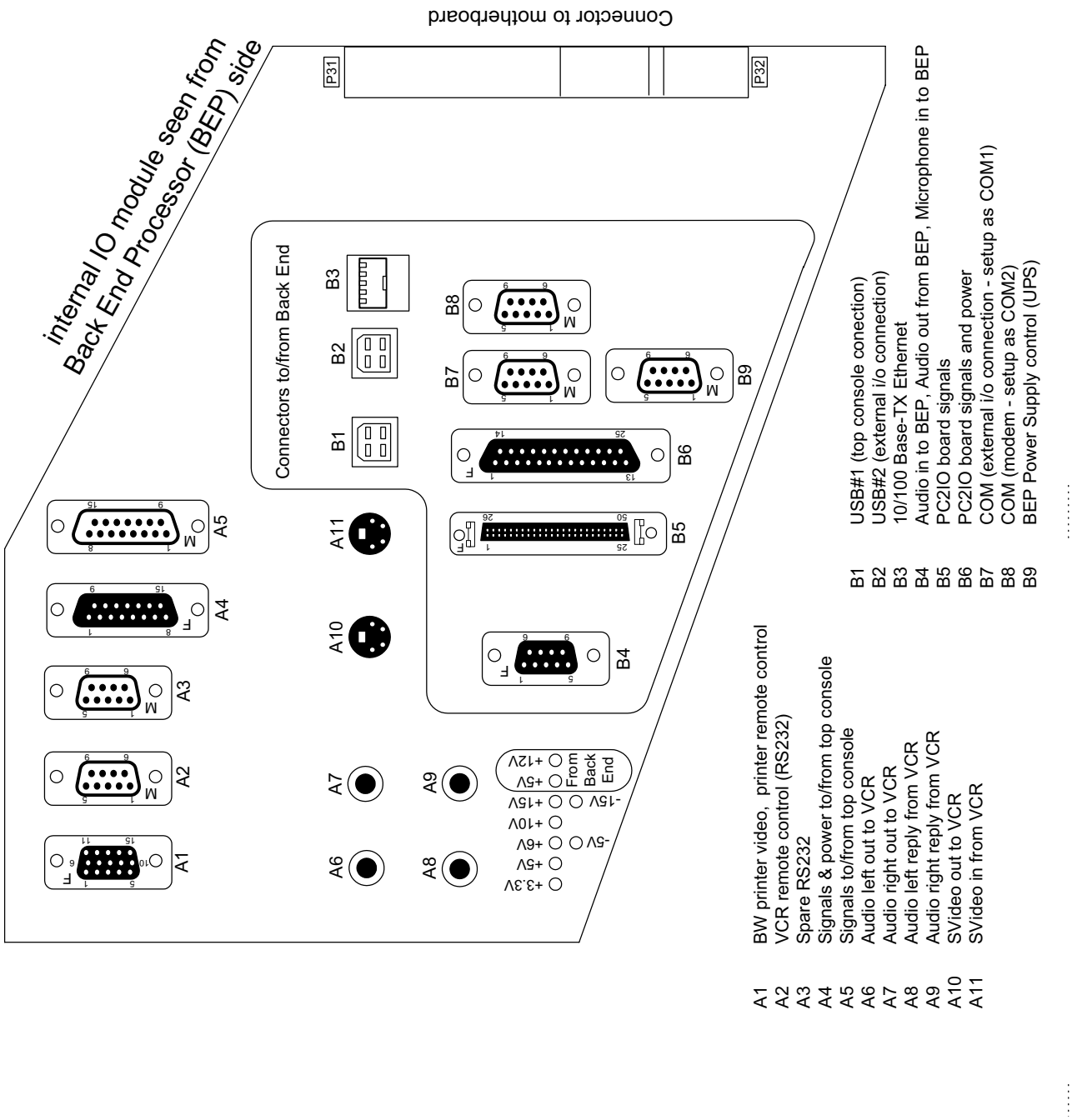


Figure 1-8 Label, Internal Connections (Int.Conn.), Upper Part

1-3-5-14 Label, Internal Connections (Int.Conn.) - Lower Part

Located on the outside of the Backend Processor's Cover (inside unit)

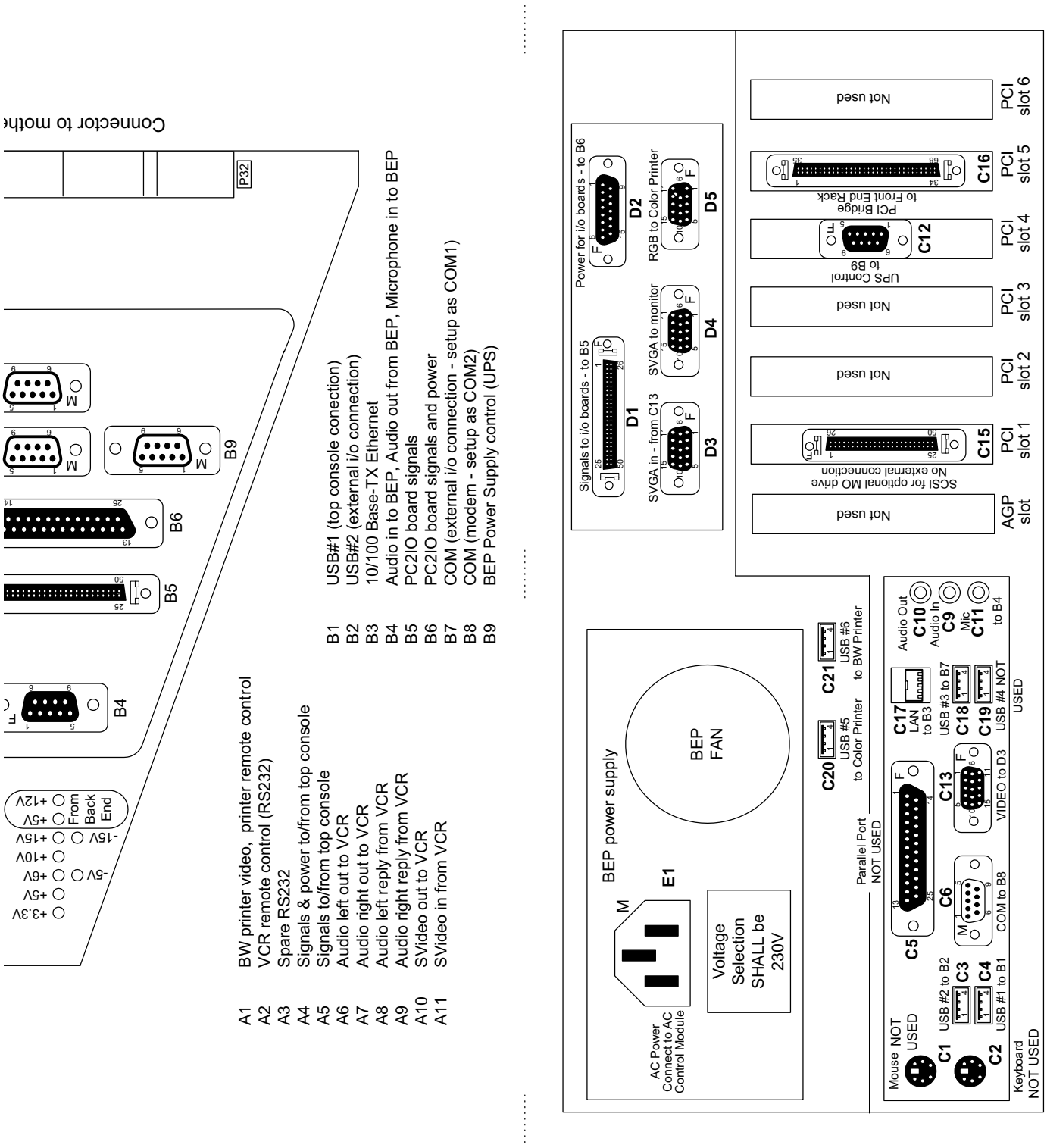


Figure 1-9 Label, Internal Connections (Int.Conn.) - Lower Part

1-3-5-15 Label, Disassembly Nester, Part 1 (Left Part of Label)

Located on the outside of the Front End Card Rack's Cover (inside unit)

DISASSEMBLY INSTRUCTIONS
Remove all screws on rear side of monitor cover, and remove cover.
Remove all screws on rear side of monitor front cover, and remove front cover.
Remove all screws on the cover located under the shelf underneath the monitor, and remove cover.
Detach monitor by removing four unbrako screws located underneath the monitor neck.
Remove shelf by loosening all screws underneath it and remove speakers from shelf.
Remove all screws underneath operators panel. Disconnect and remove alphanumeric keyboard and operators panel.
Remove probe holders and front handle.
Remove all unbrako screws, which fasten the top console cable to the console and loosen the cable.
Remove top console and horizontal movement mechanism by unscrewing the big unbrako screw on top of the rear base of the horizontal movement mechanism.
Remove all quarterturn screws on both sidepanels of the system. Side panels can now be removed.
Remove screws underneath the pedals to remove the pedal plastics.
Remove the footrest bumper by unscrewing four screws.
Remove all screws on the rear-, top- and front covers to loosen the covers.
Remove rear handle by unscrewing all screws.
Remove fan cover by removing all fastening screws.
Remove fan bracket w/fan by removing all fastening screws.
Remove all peripheral units.
Disconnect, then remove all cables.
Detach computer by unscrewing all fastening screws.
Remove external i/o box by unscrewing all fastening screws.
Remove internal i/o box by unscrewing all fastening screws.
Remove ac-power box by unscrewing all fastening screws.
Remove ac-transformer box by unscrewing all fastening screws.
Remove sheet metal cover on electronic rack on lower right side.
Remove all PCB's from the electronic rack.
Remove the two power supplys from the electronic rack by unscrewing all fastening screws.
Unscrew two screws on the connector (front) panel of the electronic rack, and remove the panel.
Remove the electronic cabinet by unscrewing all fastening screws in front of it and behind of it.
Remove the pedal mechanism by unscrewing all fastening screws.
Remove the wheels by unscrewing all fastening screws.

Figure 1-10 Label, Disassembly Instruction, Part 1 (Left Part of Label)

1-3-5-16 Label, Disassembly Nester, Part 2 (Right Part of Label)

Located on the outside of the Front End Card Rack's Cover (inside unit)

PARTS DESCRIPTION	DISPOSITION
Painted sheet metal, aluzinc steel	Recyclable metal after cleaning
Sheet metal, aluzinc	Recyclable metal
Printed circuit boards	Recycling
Cables	Recyclable metal. All cables are UL listed.
Nuts, steel + nylock	Recyclable metal after cleaning
Nuts, steel	Recyclable metal
Screws, steel + painted	Recyclable metal after cleaning
Screws, steel	Recyclable metal
Casters w/rubber	Recyclable metal and plastics
Beryllium copper	Recyclable metal
Lithium battery	To be handled by battery recycler
Covers, made from ABS plastic	To be handled by plastics recycler
Bumpers, made from EPP (expanding polypropylen)	To be handled by plastics recycler
Shelf made from Polyuretan, liquid painted	To be handled by plastics recycler
Foot pedal, plastics made from EPP (expanding polypropylen)	To be handled by plastics recycler
Peripheral units	Follow disassembly/recycling instructions from original manufacturer
Computer	Follow disassembly/recycling instructions from original manufacturer
Ferrite cores	Reusable
Electric fans	Reusable

Figure 1-11 Label, Disassembly Instruction, Part 2 (Right Part of Label)

1-3-5-17 Labels on Footswitch

Table 1-16 Labels on Footswitch

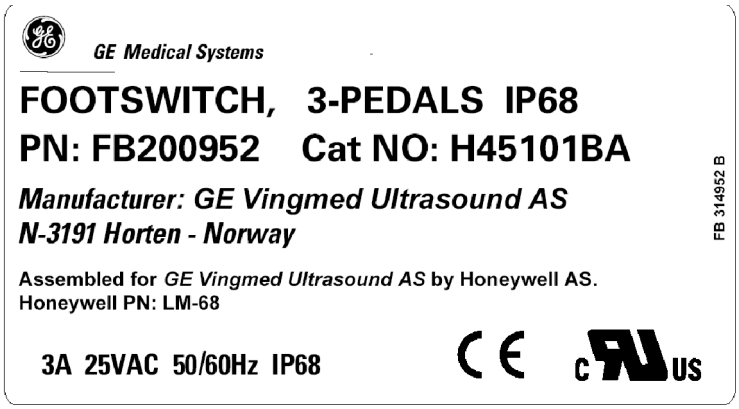
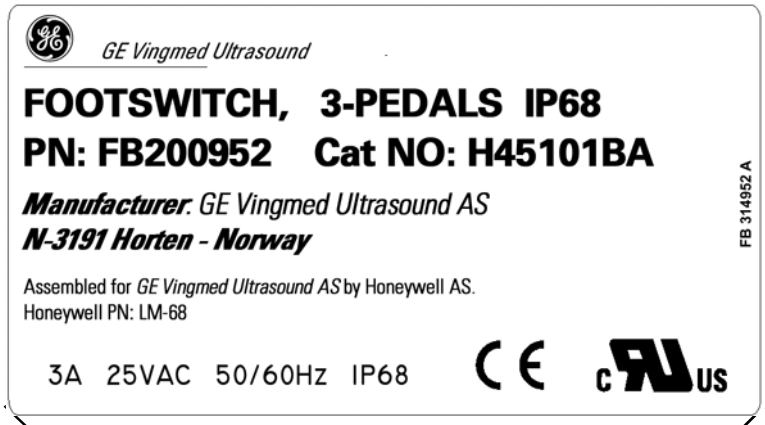
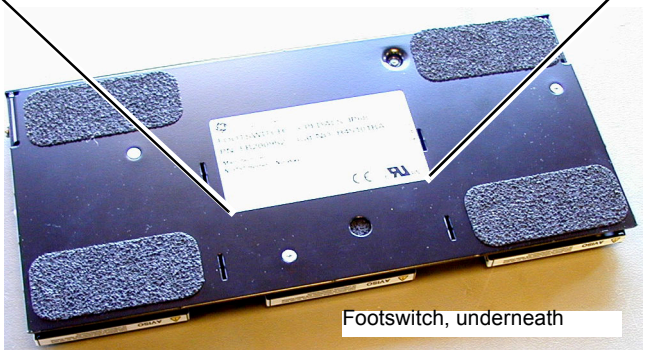
DESCRIPTION	ILLUSTRATION
Label, Footswitch	 or   Footswitch, underneath

Table 1-16 Labels on Footswitch (continued)

DESCRIPTION	ILLUSTRATION
LABEL, GE VINGMED or LABEL, GE MEDICAL SYSTEMS	

1-3-6 Dangerous Procedure Warnings

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

DANGER **DANGEROUS VOLTAGES, CAPABLE OF CAUSING DEATH, ARE PRESENT IN THIS EQUIPMENT. USE EXTREME CAUTION WHEN HANDLING, TESTING AND ADJUSTING.**



WARNING ***EXPLOSION WARNING***

DO NOT OPERATE THE EQUIPMENT IN AN EXPLOSIVE ATMOSPHERE. OPERATION OF ANY ELECTRICAL EQUIPMENT IN SUCH AN ENVIRONMENT CONSTITUTES A DEFINITE SAFETY HAZARD.

WARNING ***DO NOT SUBSTITUTE PARTS OR MODIFY EQUIPMENT.***

BECAUSE OF THE DANGER OF INTRODUCING ADDITIONAL HAZARDS, DO NOT INSTALL SUBSTITUTE PARTS OR PERFORM ANY UNAUTHORIZED MODIFICATION OF THE EQUIPMENT.

1-3-7 Lockout/Tagout Requirements (For USA Only)

Follow OSHA Lockout/Tagout requirements by ensuring you are in total control of the AC power plug at all times during the service process.

Section 1-4
EMC, EMI, and ESD

1-4-1 Electromagnetic Compatibility (EMC) and Interference (EMI)

Electromagnetic compatibility describes a level of performance of a device within its electromagnetic environment. This environment consists of the device itself and its surroundings including other equipment, power sources and persons with which the device must interface. Inadequate compatibility results when a susceptible device fails to perform as intended due interference from its environment or when the device produces unacceptable levels of emission to its environment. This interference is often referred to as radio–frequency or electromagnetic interference (RFI/EMI) and can be radiated through space or conducted over interconnecting power of signal cables. In addition to electromagnetic energy, EMC also includes possible effects from electrical fields, magnetic fields, electrostatic discharge and disturbances in the electrical power supply.

1-4-2 CE Compliance

Vivid 7 / Vivid 7 PRO conforms to all applicable conducted and radiated emission limits and to immunity from electrostatic discharge, radiated and conducted RF fields, magnetic fields and power line transient requirements.

Applicable standards are: 47CFR Part 18, IEC 601–1–2, and 806–13.

NOTE: For CE Compliance, it is critical that all covers, screws, shielding, gaskets, mesh, clamps, are in good condition, installed tightly without skew or stress. Proper installation following all comments noted in this service manual is required in order to achieve full EMC performance.

1-4-3 Electrostatic Discharge (ESD) Prevention

WARNING ***DO NOT TOUCH ANY BOARDS WITH INTEGRATED CIRCUITS PRIOR TO TAKING THE NECESSARY ESD PRECAUTIONS:***



1. ALWAYS CONNECT YOURSELF, VIA AN ARM-WRIST STRAP, TO THE ADVISED ESD CONNECTION POINT LOCATED ON THE REAR OF THE SCANNER (TO THE RIGHT OF THE POWER CONNECTOR).

2. FOLLOW GENERAL GUIDELINES FOR HANDLING OF ELECTROSTATIC SENSITIVE EQUIPMENT.

Section 1-5
Customer Assistance

1-5-1 Contact Information

If this equipment does not work as indicated in this service manual or in the User Manual, or if you require additional assistance, please contact the local distributor or appropriate support resource, as listed below.

Prepare the following information before you call:

- System ID serial number, --see label on rear side of unit.
- Software version.

Table 1-17 Phone Numbers for Customer Assistance

Location	Phone Number
USA/ Canada GE Medical Systems Ultrasound Service Engineering 4855 W. Electric Avenue Milwaukee, WI 53219 Customer Answer Center	Tel: 1-800-321-7937 1-800-682-5327 1-262-524-5698 Fax: +1-414-647-4125
Latin America GE Medical Systems Ultrasound Service Engineering 4855 W. Electric Avenue Milwaukee, WI 53219 Customer Answer Center	Tel: 1-262-524-5300 1-262-524-5698 Fax: +1-414-647-4125
Europe GE Ultraschall Deutschland GmbH& Co. KG BeethovenstraBe 239 Postfach 11 05 60, D-42655 Solingen Germany	Tel: +49 212 2802 208 - CARDIAC +49 212 2802 207 - GENERAL IMAGING Fax: +49 212 2802 431
Asia (Singapore) GE Ultrasound Asia Service Department - Ultrasound 298 Tiong Bahru Road #15-01/06 Central Plaza Singapore 169730	Tel: +65-6277-3512 Fax: +65 6272-3997

1-5-2 System Manufacture

Table 1-18 System Manufacture

MANUFACTURER	PHONE NUMBER	FAX NUMBER
GE Vingmed Ultrasound A/S Strandpromenaden 45 P.O. Box 141 N-3191 HORTEN NORWAY	+47 3302 1100	+47 3302 1350

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Chapter 2
Pre-Installation

Section 2-1
Overview

2-1-1 Purpose of Chapter 2

This chapter provides the information required to plan and prepare for the installation of a Vivid 7 / Vivid 7 PRO. Included are descriptions of the facility and electrical needs to be met by the purchaser of the unit.

Table 2-1 Contents in Chapter 2

Section	Description	Page Number
2-1	Overview	2-1
2-2	General Console Requirements	2-2
2-3	Facility Needs	2-7

Section 2-2
General Console Requirements

2-2-1 Console Environmental Requirements

CAUTION **If the unit is very cold or hot, do not turn on its power until it has had a chance to acclimate to its operating environment.**

Table 2-2 Time for Settlement

°C	60	55	50	45	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40
°F	140	131	122	113	104	96	86	77	68	59	50	41	32	23	14	5	-4	-13	-22	-31	-40
hrs	8	6	4	2	0	0	0	0	0	0	0	2	4	6	8	10	12	14	16	18	20

Table 2-3 Environmental Specifications for Vivid 7 / Vivid 7 PRO Scanners

Operating temperature	Storage temperature	Humidity	Heat dissipation
10 to 35 ^{O}C (50 to 95 ^{O}F)	-20 to 50 ^{O}C (- 4 to 122 ^{O}F)	< 90% rH non-condensing	3500 BTU pr hour

2-2-1-1 Cooling

The cooling requirement for the Vivid 7 / Vivid 7 PRO is 3500 BTU/hr. This figure does not include cooling needed for lights, people, or other equipment in the room. Each person in the room places an additional 300 BTU/hr. demand on the cooling system.

2-2-1-2 Lighting

Bright light is needed for system installation, updates and repairs. However, operator and patient comfort may be optimized if the room light is subdued and indirect. Therefore a combination lighting system (dim/bright) is recommended. Keep in mind that lighting controls and dimmers can be a source of EMI which could degrade image quality. These controls should be selected to minimize possible interference.

2-2-2 Electrical Requirements

NOTE: GE Medical Systems requires a dedicated power and ground for the proper operation of its Ultrasound equipment. This dedicated power shall originate at the last distribution panel before the system.

Sites with a mains power system with defined Neutral and Live:
The dedicated line shall consist of one phase, a neutral (not shared with any other circuit), and a full size ground wire from the distribution panel to the Ultrasound outlet.

Sites with a mains power system without a defined Neutral:
The dedicated line shall consist of one phase (two lines), not shared with any other circuit, and a full size ground wire from the distribution panel to the Ultrasound outlet.

Please note that image artifacts can occur, if at any time within the facility, the ground from the main facility's incoming power source to the Ultrasound unit is only a conduit.

2-2-2-1 Electrical Requirements for Vivid 7 and Vivid 7 PRO

Electrical Specifications for Vivid 7 and Vivid 7 PRO. Monitor and on board peripherals are included.

Table 2-4 Electrical Specifications for Vivid 7 / Vivid 7 PRO

GE VINGMED PART NUMBER	DESCRIPTION	VOLTAGE	TOLERANCES	CURRENT	FREQUENCY
FB000030	VIVID 7 (BT '01)	230 VAC	±10%	5 A	50-60 Hz
FC000060	VIVID 7 (BT '01)	115 VAC	±10%	10 A	50-60 Hz
FC000180	VIVID 7 PRO (BT '02)	230 VAC	±10%	5 A	50-60 Hz
FC000190	VIVID 7 PRO (BT '02)	115 VAC	±10%	10 A	50-60 Hz
FC000200	VIVID 7 (BT '02)	230 VAC	±10%	5 A	50-60 Hz
FC000210	VIVID 7 (BT '02)	115 VAC	±10%	10 A	50-60 Hz

2-2-2-2 Inrush Current

- 230 VAC: 12 A
- 120 VAC: 7 A

2-2-2-3 Site Circuit Breaker

It is recommended that the branch circuit breaker for the unit be readily accessible.

CAUTION **POWER OUTAGE MAY OCCUR. The Vivid 7 / Vivid 7 PRO requires a dedicated single branch circuit. To avoid circuit overload and possible loss of critical care equipment, make sure you DO NOT have any other equipment operating on the same circuit.**

2-2-2-4 Site Power Outlets

A dedicated AC power outlet must be within reach of the unit without extension cords. Other outlets adequate for the external peripherals, medical and test equipment needed to support this unit must also be present within 1 m (3.2 ft.) of the unit. Electrical installation must meet all current local, state, and national electrical codes.

2-2-2-5 Unit Power Plug

If the unit arrives without a power plug, or with the wrong plug, you must contact your GE dealer or the installation engineer must supply what is locally required.

2-2-2-6 Power Stability Requirements

Voltage drop-out

Max 10 ms.

Power Transients

(All applications)

Less than 25% of nominal peak voltage for less than 1 millisecond for any type of transient, including line frequency, synchronous, asynchronous, or aperiodic transients.

2-2-3 EMI Limitations

Ultrasound machines are susceptible to Electromagnetic Interference (EMI) from radio frequencies, magnetic fields, and transients in the air or wiring. They also generate EMI. The Vivid 7 / Vivid 7 PRO complies with limits as stated on the EMC label. However there is no guarantee that interference will not occur in a particular installation.

Possible EMI sources should be identified before the unit is installed.

Electrical and electronic equipment may produce EMI unintentionally as the result of a defect. These sources include:

- medical lasers,
- scanners,
- cauterizing guns,
- computers,
- monitors,
- fans,
- gel warmers,
- microwave ovens,
- light dimmers
- portable phones.

The presence of a broadcast station or broadcast van may also cause interference.

See Table 2-5 on page 2-5 for EMI Prevention tips.

2-2-3 EMI Limitations (cont'd).

Table 2-5 EMI Prevention/abatement

EMI Rule	Details
Be aware of RF sources	Keep the unit at least 5 meters or 15 feet away from other EMI sources. Special shielding may be required to eliminate interference problems caused by high frequency, high powered radio or video broadcast signals.
Ground the unit	Poor grounding is the most likely reason a unit will have noisy images. Check grounding of the power cord and power outlet.
Replace all screws, RF gaskets, covers, cores	After you finish repairing or updating the system, replace all covers and tighten all screws. Any cable with an external connection requires a magnet wrap at each end. Install the Card Rack cover over the Card Rack. Loose or missing covers or RF gaskets allow radio frequencies to interfere with the ultrasound signals.
Replace broken RF gaskets	If more than 20% or a pair of the fingers on an RF gasket are broken, replace the gasket. Do not turn on the unit until any loose metallic part is removed.
Do not place labels where RF gaskets touch metal	Never place a label where RF gaskets meet the unit. Otherwise, the gap created will permit RF leakage. Or, if a label has been found in such a position, move the label.
Use GE specified harnesses and peripherals	The interconnect cables are grounded and require ferrite beads and other shielding. Also, cable length, material, and routing are all important; do not change from what is specified.
Take care with cellular phones	Cellular phones may transmit a 5 V/m signal; that could cause image artifacts.
Properly dress peripheral cables	Do not allow cables to lie across the top of the Card Rack or hang out of the peripheral bays. Loop the excess length for peripheral cables inside the peripheral bays. Attach the monitor cables to the frame.

2-2-4 Probes Environmental Requirements

Table 2-6 Operation and Storage Temperatures for Probes.

	Electronic	PAMPTE
Operation:	10 to 40 ^{o}C (50 to 104 ^{o}F)	5 to 42.7 ^{o}C (41 to 108,9 ^{o}F)
Storage:	-20 to 50 ^{o}C (-4 to 122 ^{o}F)	-20 to 50 ^{o}C (-4 to 122 ^{o}F)
Temperatures in degrees Celsius (^{o}C) conversion to degrees F (^{o}F) = (^{o}C * 9/5) + 32		

CAUTION **Systems and electronic probes are designed for storage temperatures of -20 to + 50 degrees C (-4 to +122 degrees F). when exposed to large temperature variations, the product should be kept at room temperature the needed time to stabilize its temperature before use. Refer to Table 3-3 on page 3-2 to determine the needed settlement time.**

2-2-5 Time and Manpower Requirements

Site preparation takes time. Begin Pre-installation checks as soon as possible, if possible, six weeks before delivery, to allow enough time to make any changes.

CAUTION **Have two people available to deliver and unpack the Vivid 7 / Vivid 7 PRO. Attempts to move the unit considerable distances or on an incline by one person could result in injury or damage or both.**



Section 2-3
Facility Needs

2-3-1 Purchaser Responsibilities

The work and materials needed to prepare the site is the responsibility of the purchaser. Delay, confusion, and waste of manpower can be avoided by completing pre installation work before delivery. Purchaser responsibility includes:

- Procuring the materials required.
- Completing the preparations before delivery of the ultrasound system.
- Paying the costs for any alterations and modifications not specifically provided in the sales contract.

NOTE: All electrical installations that are preliminary to the positioning of the equipment at the site prepared for the equipment must be performed by licensed electrical contractors. Other connections between pieces of electrical equipment, calibrations, and testing must also be performed by qualified personnel. The products involved (and the accompanying electrical installations) are highly sophisticated and special engineering competence is required. All electrical work on these products must comply with the requirements of applicable electrical codes. The purchaser of GE equipment must only utilize qualified personnel to perform electrical servicing on the equipment.

The desire to use a non–listed or customer provided product or to place an approved product further from the system than the interface kit allows, presents challenges to the installation team. To avoid delays during installation, such variances should be made known to the individuals or group performing the installation at the earliest possible date (preferably prior to the purchase).

The ultrasound suite must be clean prior to delivery of the machine. Carpet is not recommended because it collects dust and creates static. Potential sources of EMI (electromagnetic interference) should also be investigated before delivery. Dirt, static, and EMI can negatively impact system reliability.

2-3-2 Required Facility Needs

NOTE: GE Medical Systems requires a dedicated power and ground for the proper operation of its Ultrasound equipment. This dedicated power shall originate at the last distribution panel before the system.

Sites with a mains power system with defined Neutral and Live:
The dedicated line shall consist of one phase, a neutral (not shared with any other circuit), and a full size ground wire from the distribution panel to the Ultrasound outlet.

Sites with a mains power system without a defined Neutral:
The dedicated line shall consist of one phase (two lines), not shared with any other circuit, and a full size ground wire from the distribution panel to the Ultrasound outlet.

Please note that image artifacts can occur, if at any time within the facility, the ground from the main facility's incoming power source to the Ultrasound unit is only a conduit.

- Dedicated single branch power outlet of adequate amperage (see Table 2-4 on page 2-3) meeting all local and national codes which is located less than 2.5 m (8 ft.) from the unit's proposed location
- Door opening is at least 76 cm (30 in) wide
- Proposed location for unit is at least 0.3 m (1 ft.) from the wall for cooling
- Power outlet and place for any external peripheral are within 2 m (6.5 ft) of each other with peripheral within 1 m of the unit to connect cables.

NOTE: The Vivid 7 / Vivid 7 PRO has four outlets inside the unit. One is for the monitor and three for on board peripherals.

- Power outlets for other medical equipment and gel warmer
- Power outlets for test equipment within 1 m (3.2 ft) of unit
- Clean and protected space to store transducers (in their cases or on a rack)
- Material to safely clean probes (done with a plastic container, never metal)

2-3-3 Desirable Features

- Door is at least 92 cm (3 ft.) wide
- Circuit breaker for dedicated power outlet is easily accessible
- Sink with hot and cold water
- Receptacle for bio–hazardous waste, like used probe sheaths
- Emergency oxygen supply
- Storage for linens and equipment
- Nearby waiting room, lavatory, and dressing room
- Dual level lighting (bright and dim)
- Lockable cabinet ordered by GE for its software and proprietary manuals

2-3-4 Minimal Floor Plan Suggestion

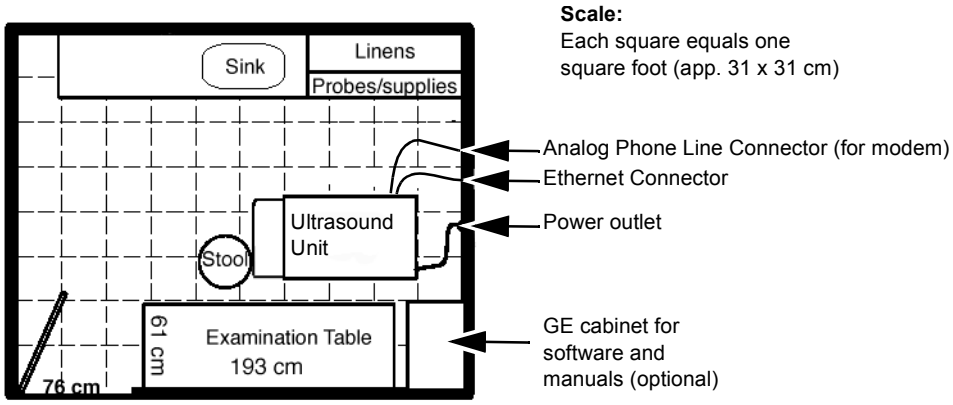


Figure 2-1 Minimal Floor Plan, 2.5m x 3m (8 by 10 foot)

2-3-5 Networking Pre-installation Requirements

2-3-5-1 Stand Alone Scanner (without Network Connection)

None.

2-3-5-2 Scanner Connected to Hospital's Network

Supported networks:

DICOM Network (option)

2-3-5-3 Purpose of the DICOM Network Function

DICOM services provide the operator with clinically useful features for moving images and patient information over a hospital network. Examples of DICOM services include the transfer of images to workstations for viewing or transferring images to remote printers. As an added benefit, transferring images in this manner frees up the on-board monitor and peripherals, enabling viewing to be done while scanning continues. With DICOM, images can be archived, stored, and retrieved faster, easier, and at a lower cost.

2-3-5-4 DICOM Option Pre-installation Requirements

To configure the Vivid 7 / Vivid 7 PRO to work with other network connections, the site's network administrator must provide information to complete the form in Figure 2-2 - Worksheet for DICOM Network Information. Ensure that there are no spaces in any field of the form.

Entries must include:

- A host name, local port number, AE Title, IP address and Net Mask for the Vivid 7 / Vivid 7 PRO.
- The IP addresses for the default gateway and other routers at the site for ROUTING INFORMATION.
- The host name, IP address, port and AE Title for each device the site wants connected to the Vivid 7 / Vivid 7 PRO for DICOM APPLICATION INFORMATION. A field for the make (manufacturer) and the revision of the device, is also included. This information may be useful for error solving.

2-3-5 Networking Pre-installation Requirements (cont'd).

Vivid 7 /
Vivid 7 PRO
Host Name _____ Local Port _____ IP Address ___ . ___ . ___ . ___
AE Title _____ Net Mask ___ . ___ . ___ . ___

ROUTING INFORMATION

	Destination IP Addresses	GATEWAY IP Addresses
Default		___ . ___ . ___ . ___
ROUTER1	___ . ___ . ___ . ___	___ . ___ . ___ . ___
ROUTER2	___ . ___ . ___ . ___	___ . ___ . ___ . ___
ROUTER3	___ . ___ . ___ . ___	___ . ___ . ___ . ___

DICOM APPLICATION INFORMATION

	NAME	MAKE/REVISION	AE TITLE	IP ADDRESSES	PORT
Store 1				___ . ___ . ___ . ___	
Store 2				___ . ___ . ___ . ___	
Store 3				___ . ___ . ___ . ___	
Store 4				___ . ___ . ___ . ___	
Store 5				___ . ___ . ___ . ___	
Store 6				___ . ___ . ___ . ___	
Work list				___ . ___ . ___ . ___	
Storage Commit				___ . ___ . ___ . ___	
MPPS				___ . ___ . ___ . ___	

Figure 2-2 Worksheet for DICOM Network Information

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Chapter 3
Installation

Section 3-1
Overview

3-1-1 Purpose of Chapter 3

This chapter contains information needed to install Vivid 7 / Vivid 7 PRO. Included is a procedure that describes how to receive and unpack the equipment and how to file a damage or loss claim.

How to prepare the facility and unit of the actual installation, and how to check and test the unit, probes, and external peripherals for electrical safety are included in this procedure. Also included in this section are guidelines for transporting the unit to a new site.

Table 3-1 Contents in Chapter 3

Section	Description	Page Number
3-1	Overview	3-1
3-3	Receiving and Unpacking the Equipment	3-3
3-6	Preparing for Installation	3-8
3-7	Completing the Installation	3-8
3-8	Configuration	3-21
3-9	Connectivity	3-35
3-10	Installation Paperwork	3-56

Section 3-2
Installation Reminders

3-2-1 Average Installation Time

Table 3-2 Average Installation Time

Description	Average Installation Time	Comments
Unpacking the scanner	0.5 hour	
Install Scanner wo/options	4 hours	Dependent on the configuration
DICOM Network Configuration	2 hour	Dependent on the configuration
Install InSite / iLink	0.5 hour	

3-2-2 Installation Warnings

DANGER **When using any test instrument that is capable of opening the ac ground line (i.e., meter's ground switch is open), don't touch the unit!**

CAUTION **If the unit is very cold or hot, do not turn on its power until it has had a chance to acclimate to its operating environment.**

Table 3-3 Time for Settlement

°C	60	55	50	45	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40
°F	140	131	122	113	104	96	86	77	68	59	50	41	32	23	14	5	-4	-13	-22	-31	-40
hrs	8	6	4	2	0	0	0	0	0	0	0	2	4	6	8	10	12	14	16	18	20

CAUTION **To prevent electrical shock, connect the unit to a properly grounded power outlet. Do not use a three to two prong adapter. This defeats safety grounding.**

CAUTION **Do not wear the ESD wrist strap when you work on live circuits and more than 30 V peak is present.**

CAUTION **Do not operate this unit unless all board covers and frame panels are securely in place. System performance and cooling require this.**

CAUTION **OPERATOR MANUAL(S)**

The User Manual(s) should be fully read and understood before operating the Vivid 7 / Vivid 7 PRO and kept near the unit for quick reference.

CAUTION **Acoustic Output Hazard**

Although the ultrasound energy transmitted from the Vivid 7 / Vivid 7 PRO probe is within AIUM/ NEMA standards, avoid unnecessary exposure. Ultrasound energy can produce heat and mechanical damage.



Section 3-3
Receiving and Unpacking the Equipment

CAUTION **Please read this procedure before unpacking the Vivid 7 / Vivid 7 PRO.**

3-3-1 Introduction

Vivid 7 / Vivid 7 PRO is a fine tuned electronic equipment, and should be treated properly during transportation.

If the box is damaged or if the tilt & drop indicators show failure, please inform the sales representative immediately. Do also fill in that the tilt & drop indicators show failure in the “Package” column on the Post delivery checklist.

See “Damage In Transportation“ on page *v* in the beginning of this manual.

We strongly advice you to store the Vivid 7 / Vivid 7 PRO packing material in undamaged condition in case of future transportation.

The weight of the special designed wooden transportation box, with a Vivid 7 / Vivid 7 PRO and other normal equipment included, is approximate 300 kg (615 lbs).

CAUTION **Have two people available to unpack the Vivid 7 / Vivid 7 PRO.**

Attempts to move the unit considerable distances or on an incline by one person could result in injury or damage or both.



Section 3-4
Receiving Vivid 7 / Vivid 7 PRO

3-4-1 Introduction

Vivid 7 / Vivid 7 PRO is a fine tuned electronic equipment, and should be treated properly during transportation.

NOTE: If the box is damaged or if the tilt & drop indicators show failure, please inform the sales representative immediately. Do also fill in that the tilt & drop indicators show failure in the "Package" column on the Post delivery checklist.



Figure 3-1 Tilt and Drop Indicators

We strongly advice you to store the packing materials in undamaged condition in case of future transportation the equipment.

Section 3-5
Unpacking Vivid 7 / Vivid 7 PRO

Table 3-4 Unpacking Vivid 7 / Vivid 7 PRO

Step	Task
1.	Open the four hinges on each door and remove the doors. One of the doors are used as ramp out off and into the transportation box. On the first version of the Transportation Box, only the front door is meant to be used as a ramp. It has bevel cut in one end.   Front door bevel cut. This end of the door should be used as the lower end of the ramp.
2.	Place the front door as a ramp against the rear edge of the pallet.  On the first version transportation box, which is no longer manufactured by GE, a 10 cm board (not furnished) is placed as a support under the upper end of the ramp.  **"Labank"** On the second version transportation box, the ramp is placed directly on the labank ends.
3.	Carefully remove the accessory box, and any other items, including the wooden shelf above the scanners keyboard and all the filling material, from the Transportation Box.

Table 3-4 Unpacking Vivid 7 / Vivid 7 PRO (continued)

Step	Task
4.	The rear wheels on Vivid 7 / Vivid 7 PRO do not have a direction lock. That is why the instrument has to be removed through the rear end of the Transportation Box. Press once on the brake pedal to release the brakes. Keep direction lock activated. The direction lock keeps the front wheels from swiveling and blocking the system inside the narrow transportation box. 
5.	Carefully move the instrument out of the Transportation Box, down the ramp, with rear end first. 
6.	Remove the clear plastic (wrapped around the scanner) from the unit.
7.	Place all the filling material inside the Transportation Box, close it and store it for possible use in the future.
8.	You may want to start to fill out the *Product Locator Card* and the *Post Delivery Check List*, see "Installation Paperwork" on page 3-56

3-5-1 Transportation Box Dimensions

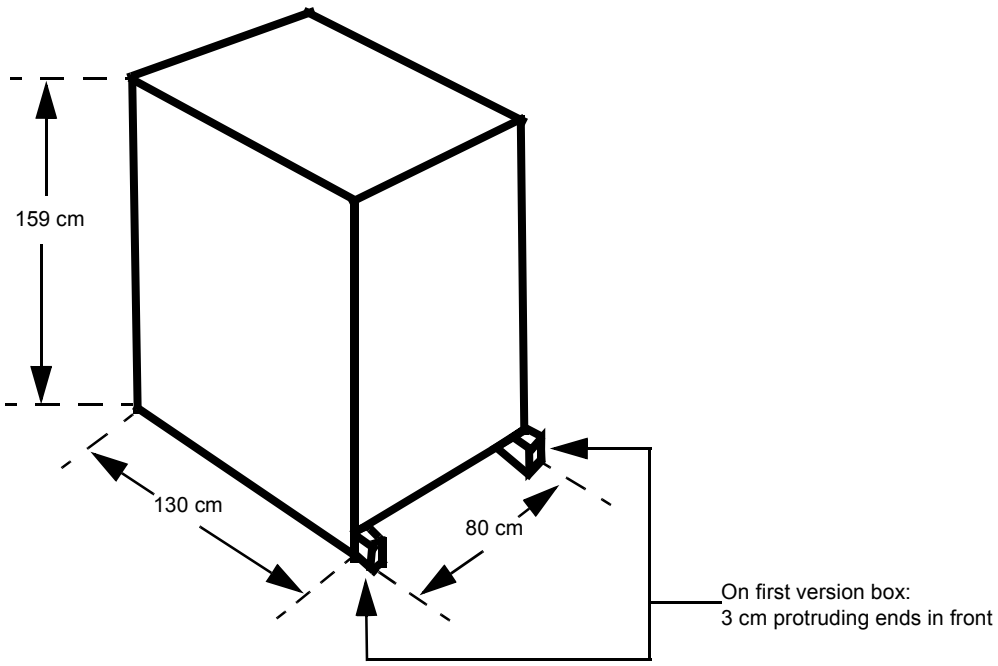


Figure 3-2 Transportation box dimensions

Section 3-6
Preparing for Installation

3-6-1 Physical Inspection

- Verify that the system arrived intact (visual inspection).
  If damaged, refer to “Damage In Transportation“on page v in this manual.
- Verify that all items are present (see the Packing List)

3-6-2 EMI Protection

This unit has been designed to minimize the effects of Electro-Magnetic Interference (EMI). Many of the covers, shields, and screws are provided primarily to protect the system from image artifacts caused by this interference. For this reason, it is imperative that all covers and hardware are installed and secured before the unit is put into operation.

See *Chapter 2*, *"EMI Limitations" on page 2-4* for more information about EMI protection.

Section 3-7
Completing the Installation

3-7-1 System Specifications

3-7-1-1 System Requirements Verification

- Verify that the site meets the requirements listed in Chapter 2 (see: "Facility Needs" on page 2-7)
- Verify that the specifications below don’t conflict with any on site conditions

3-7-1-2 Physical Dimensions

The physical dimensions of the Vivid 7 / Vivid 7 PRO unit are summarized in Table 3-5.

Table 3-5 Physical Dimensions of Vivid 7 / Vivid 7 PRO with monitor and peripherals

Height	Width	Depth	Unit
137.5 - 157.5	64	90	cm
54.1 - 62	25.2	35,4	Inches

3-7-1-3 Weight with Monitor and Peripherals

Table 3-6 Weight of Vivid 7 / Vivid 7 PRO with monitor and peripherals

Model	Weight [kg]	Weight [lbs]
Vivid 7 / Vivid 7 PRO	200	410

3-7-1-4 Acoustic Noise Output

Less than 70dB(A) according to the standard DIN 45635 - 19 - 01 - KL2.

3-7-2 Electrical Specifications

WARNING ***CONNECTING A Vivid 7 / Vivid 7 PRO UNIT TO THE WRONG VOLTAGE LEVEL WILL MOST LIKELY DESTROY THE UNIT.***

3-7-2-1 Verification of the System's Voltage Settings

Verify that the mains voltage specified for the unit is available on site.

The Voltage settings for the unit is found on the label to the left of the Mains Power Circuit Breaker on the rear of the system, see Figure 3-3 on page 3-9.

3-7-2-2 Electrical Specifications for Vivid 7 / Vivid 7 PRO.

Table 3-7 Electrical Specifications for Vivid 7 / Vivid 7 PRO

GE VINGMED PART NUMBER	DESCRIPTION	VOLTAGE	TOLERANCES	CURRENT	FREQUENCY
FB000030	VIVID 7 (BT'01)	230 VAC	±10%	5 A	50-60 Hz
FC000060	VIVID 7 (BT'01)	100 - 120 VAC	±10%	10 A	50-60 Hz
FC000180	VIVID 7 PRO (BT'02)	220 - 240 VAC	±10%	5 A	50-60 Hz
FC000190	VIVID 7 PRO (BT'02)	100 - 120 VAC	±10%	10 A	50-60 Hz
FC000200	VIVID 7 (BT'02)	220 - 240 VAC	±10%	5 A	50-60 Hz
FC000210	VIVID 7 (BT'02)	100 - 120 VAC	±10%	10 A	50-60 Hz

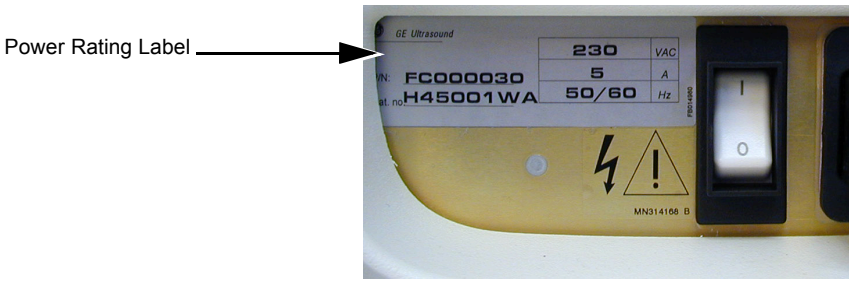


Figure 3-3 Mains Circuit Breaker and Power Rating Label

3-7-3 Connect Footswitch

Connect Footswitch to External I/O at the rear side of Vivid 7 / Vivid 7 PRO. When not in use, store it in the tray below.



Figure 3-4 Footswitch connection

3-7-4 Connect Telephone Line to Modem Connector

(For iLink/InSite Use)

Connect an analog telephone line to the Modem Connector on External I/O at the rear side of Vivid 7 / Vivid 7 PRO.

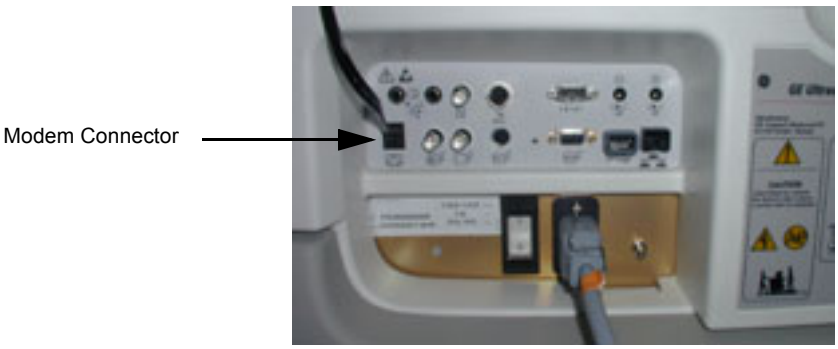


Figure 3-5 Connect an analog telephone line to Modem Connector

3-7-5 Connect ECG

Connect ECG to Patient I/O Module in the front of Vivid 7 / Vivid 7 PRO.

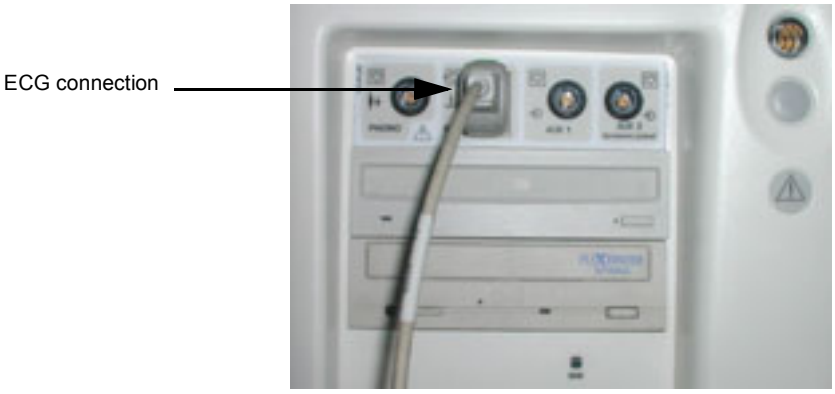


Figure 3-6 ECG connection to Patient I/O Module

3-7-6 Connect Phono

Connect Phono to Patient I/O Module in the front of Vivid 7 / Vivid 7 PRO.

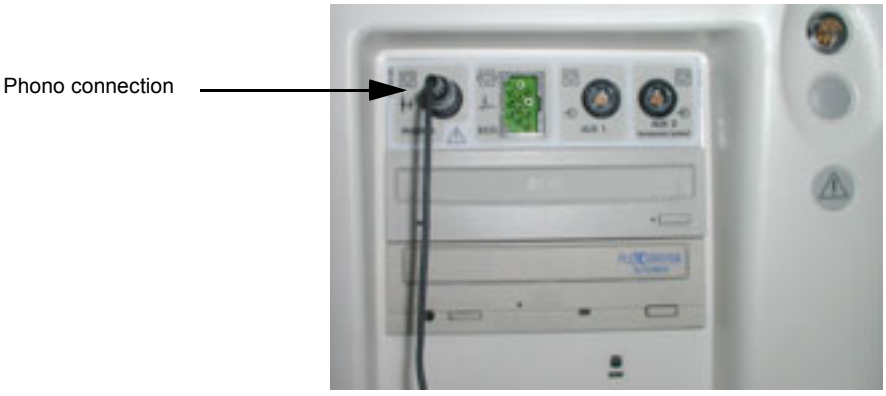


Figure 3-7 Phono connection

3-7-7 Connect Pulse Pressure Transducer

Connect Pulse Pressure Transducer to Patient I/O Module in the front of Vivid 7 / Vivid 7 PRO.

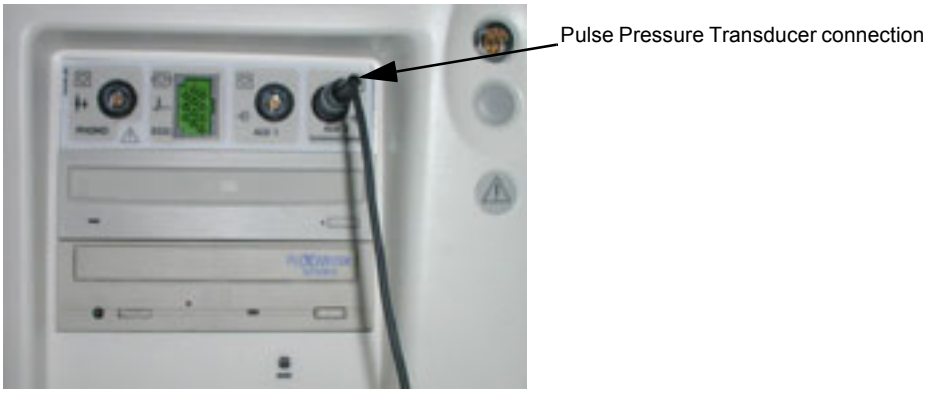


Figure 3-8 Pulse Pressure Transducer connection

3-7-8 Connect Ethernet

Connect Ethernet to External I/O at the rear side of Vivid 7 / Vivid 7 PRO.

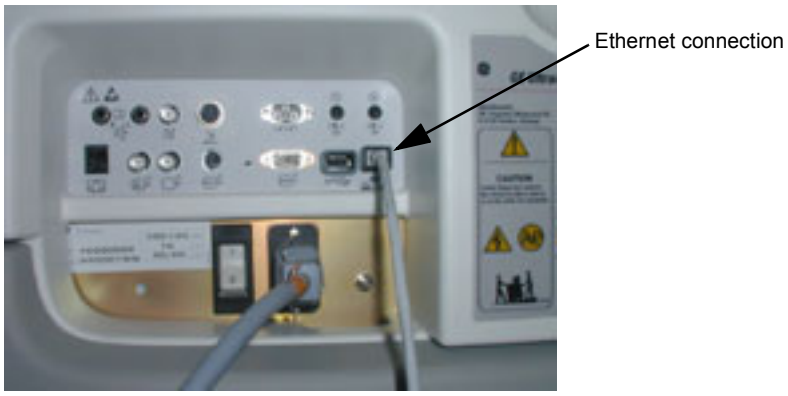


Figure 3-9 Ethernet connection

3-7-9 Probe Connection

Vivid 7 / Vivid 7 PRO has four positions to plug in probes. The connector to the left is a “dummy” connector, only used for parking one probe. The three other connectors are selectable and used for scanning.

A separate “Pedof” Doppler probe connector is also available.

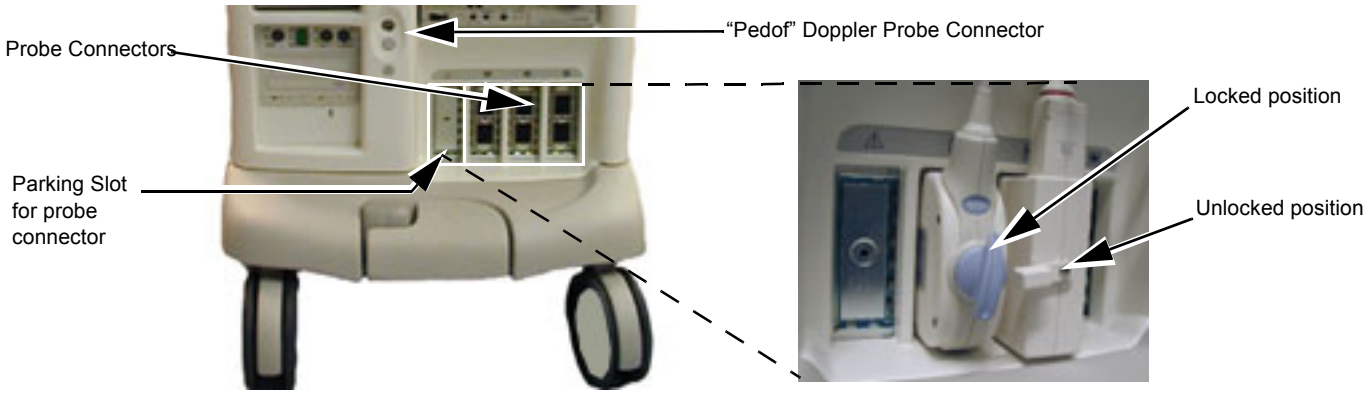


Figure 3-10 Probe Connectors

3-7-9-1 Connect a Probe

NOTE: It is not necessary to turn OFF Power to connect or disconnect a probe.

CAUTION Do not allow the probe head to hang freely. Excessive impact to the probe will result in irreparable damage.

CAUTION To prevent probe connector pins, or PCB board damage, do not use excessive force when connecting the probes.

1.) Hold the probe connector vertically with the cable pointing upward.
2.) Turn the connector locking handle counter-clockwise to the horizontal position.
3.) Align the connector with the probe port and carefully push into place.
4.) Rotate the locking handle to the full vertical position to lock in place. (See Figure 3-10.)
5.) Position the probe cable so that it is not resting on the floor.

CAUTION Take the following precautions with the probe cables:
Keep away from the wheels
Do not bend
Do not cross cables between probes.

3-7-9-2 Disconnect Probe

1.) Rotate the lock handle counter-clockwise to the horizontal position to unlock the connector. (See Figure 3-10.)
2.) Remove the connector from the port.
3.) Ensure that the probe head is clean before placing the probe in its storage case, see section 10-5-4 on page 10-7 for cleaning instructions.

3-7-10 Power ON/Boot Up

3-7-10-1 Connecting Mains Power to the Unit

DANGER **Never use a three-to-two prong adapter; this defeats the safety ground.**

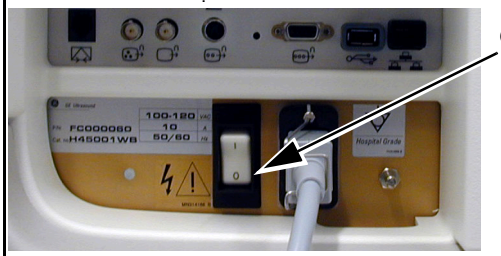
CAUTION **SYSTEM REQUIRES ALL COVERS**

Operate this unit only when all board covers and frame panels are securely in place. The covers are required for safe operation, good system performance and cooling purposes.

NOTE: Do not cycle the Circuit Breaker ON-OFF-ON in less than five -5- seconds. When turning OFF the Circuit Breaker, the system should de-energize completely before turning the circuit breaker ON.

NOTE: When turning on a system from standby mode, it takes a few seconds before it responds. Do not push the On/off button again during this period. A second push will initiate a full shutdown.

Table 3-8 Connecting Mains Power to the unit

Step	Task	Expected Result(s)
1	Connect the female plug on the Power Cable to the Power Inlet at the rear of the unit.	 Clasp OFF
2	Lock the plug in position with the retaining clasp.	The retaining clasp prevent the plug from being unplugged during use.  Clasp ON
3	Verify that the Mains Power Circuit Breaker is in OFF position, eventually switch it OFF.	 OFF Position
4	Connect the other end of the Power Cable (with the male plug) to a hospital grade mains power outlet with the proper rated voltage.	The unit is ready for Power ON/Boot Up.

3-7-10-2 Turn Unit ON

Table 3-9 Turn Unit ON

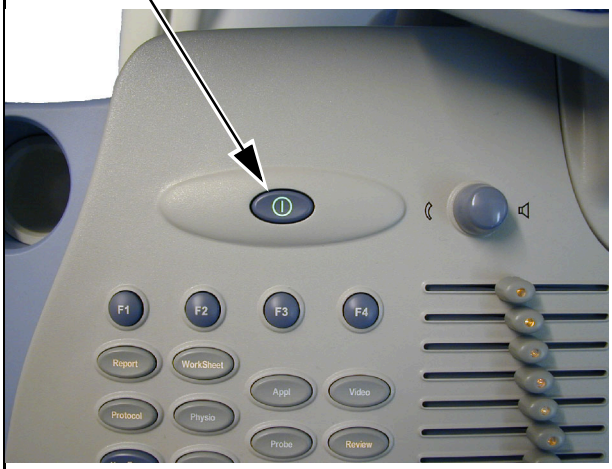
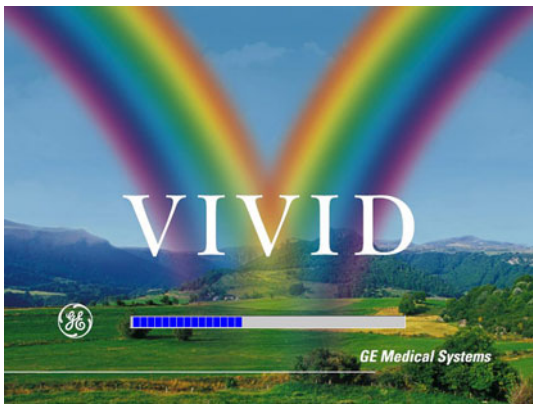
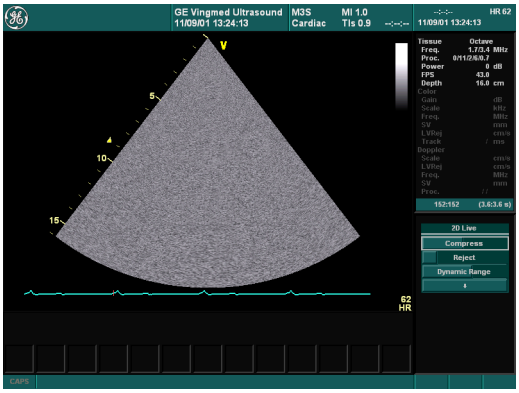
Step	Task	Expected Result(s)
1	Switch ON the Mains Power Circuit Breaker at the rear of the unit. Mains Power Circuit Breaker in ON position 	You will hear a “click” from the relays in the AC Power/AC Controller. The unit is ready for Boot Up.
2	Press the **ON/OFF** key on the Control Panel (Keyboard) once. **ON/OFF** key 	1) The unit’s ventilation fan starts on full speed, but slows down after a few seconds (listen to the fan noise). 2) Power is distributed to the peripherals, Control Panel (Console), Monitor, Card Rack and Backend Processor. 3) Backend Processor and rest of Scanner starts with the following sequence: 4) Backend Processor is turned ON and starts to load the software. 5) The Start Screen (Vivid) is displayed on the monitor 6) A start-up bar is displayed on the monitor, indicating the progress of the software loading.  *NOTE: If the unit has been in the OFF condition for an extended period of time, (3 to 5 days or more), the unit may not boot, or may beep when turned on. See “System Doesn’t Boot” on page 7-67. for more details, including how to recover.*

Table 3-9 Turn Unit ON (continued)

Step	Task	Expected Result(s)
3	Wait for the unit to boot.	The software initiates and set up the Card Rack and the rest of the instrument. The backlight in the keyboard is lit. As soon as the software has been loaded, a 2D screen is displayed on the screen.  Total time used for start-up is typically three minutes.

3-7-11 Power Shut Down

3-7-12 Switching OFF the Unit

See "Power Shut Down" on page 4-5 for a detailed description.

1.) Press the **ON/OFF** button on the top left of the Control Panel to display the Exit dialog window.
2.) Select SHUTDOWN.
The shutdown process takes a few seconds and is completed when the Control Panel illumination is turned off.

To completely switch off the unit before disconnecting the Mains Power Cable, follow the additional steps below:

3.) Set the Circuit Breaker (on rear of unit) to **OFF**.
4.) Remove the plug from the mains power outlet.

3-7-12-1 Overview

When the unit is switched off, the system performs an automatic shutdown sequence. The unit can be switched off into two states:

- **Standby Mode:**
  Most of the system is powered down, but a certain portion of the unit remains energized. The standby mode allows a shorter reboot time when the system is used on a daily basis or moved from one place to another.
- **Full Shut Down:**
  The entire system is shut down. It is recommended to perform a full shutdown at least once a week.

3-7-12-2 Power Shut Down to Standby Mode

This procedure describes the needed steps to power down the unit to Standby mode:

1.) Press the **ON/OFF** key on the Control Panel once to display the System - Exit menu on the screen.

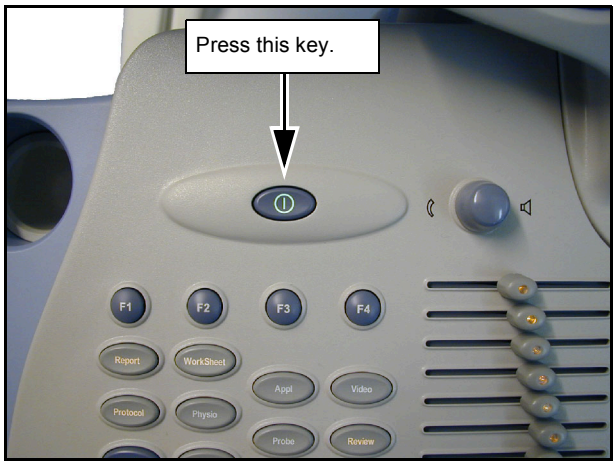


Figure 3-11 Press ON-OFF key once

3-7-12-2 Power Shut Down to Standby Mode (cont'd)

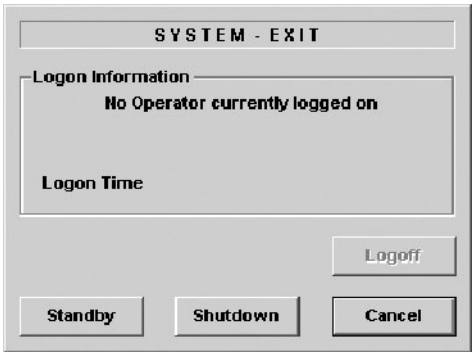


Figure 3-12 System - Exit menu

The System - Exit menu gives you the following choices:

- **Logoff**
  Use this button to log off the current user.
  The system remains on and ready for a new user to log on.
  The dimmed button in Figure 3-12 on page 3-18 indicates that no user is logged on to the unit at the moment.
- **Standby**
  Use this button to select the Standby mode, allowing a shorter reboot time. The next step describes the use of this button.
- **Shutdown...**
  Use this button to Shut Down the system.
- **Cancel**
  Use this button to exit from the System-Exit menu and return to the previous operation.

2.) Click STANDBY to select Standby mode.

If the power cable is removed from the wall outlet the system will remain in Standby mode for approximately 15 minutes. If the system is unplugged for a longer period of time, a full shutdown is automatically performed.

NOTE: When turning on a system from standby mode, it takes a few seconds before it responds. Do not push the On/off button again during this period. A second push will initiate a full shutdown.

3-7-12-3 Full Power Shut Down

This procedure describes the needed steps to do a complete power down of the system:

1.) Press the **ON/OFF** key on the Control Panel once to display the System - Exit menu on the screen.

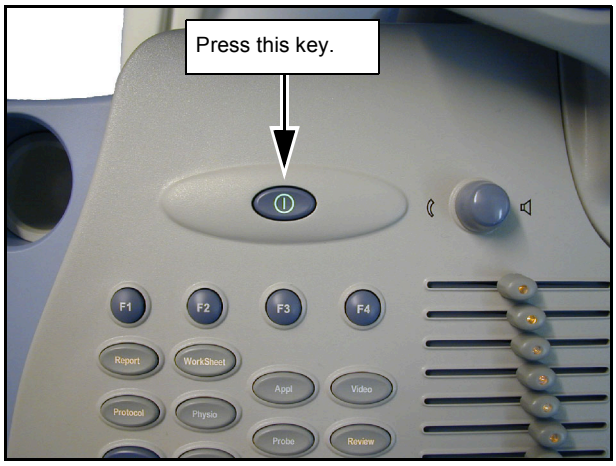


Figure 3-13 Press ON-OFF key once

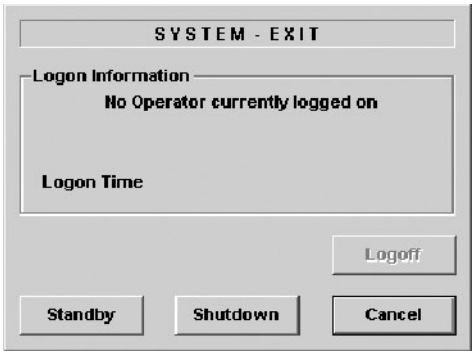


Figure 3-14 System - Exit menu

The System - Exit menu gives you the following choices:

- **Logoff**
  Use this button to log off the current user.
  The system remains on and ready for a new user to log on.
  The dimmed button in Figure 3-12 on page 3-18 indicates that no user is logged on to the unit at the moment.
- **Standby**
  Use this button to select the Standby mode, allowing a shorter reboot time.
- **Shutdown...**
  Use this button to Shut Down the system.The next step describes the use of this button.
- **Cancel**
  Use this button to exit from the System-Exit menu and return to the previous operation.

3-7-12-3 Full Power Shut Down (cont'd)

2.) Click SHUTDOWN to do a complete power down of the unit.

Backend Processor will first turn OFF the Scanner activity and print the message "Please wait - Shutdown in progress" in the LCD display. Then it starts to shut down itself. The time to turn down the Scanner including the Backend Processor, may vary from 10 seconds up to approximately 1 minute. The last thing that shut down, is the light in the LCD displays, indicating that you can continue to the next step.

3.) Switch OFF the **CIRCUIT BREAKER** (located on the rear of the unit)

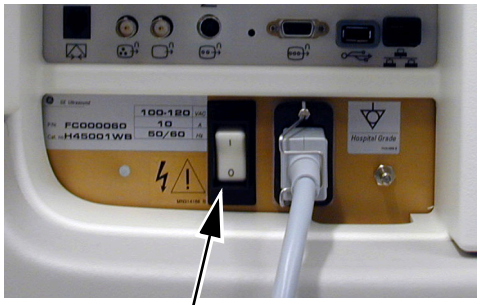


Figure 3-15 Circuit Breaker located on rear of the unit

This will cut power distribution within the unit.

If the Backend Processor is still running, the internal Un-interupted Power Supply (UPS) will switch over to battery power and supply the Backend Processor with power until it has shut down properly. A periodic high-pitch sound alarm indicates that the Backend Processor is running on battery power.

Section 3-8
Configuration

OVERVIEW

Table 3-10 Contents in Section 3-5

Sub-section	Description	Page Number
3-8-1	Vivid 7 / Vivid 7 PRO Configuration	3-21
3-8-1-1	Log on to the system	3-22
3-8-1-2	Enter Location	3-24
3-8-1-3	Date and Time Adjustments	3-25
3-8-1-4	Language Selection	3-26
3-8-1-5	Units of Measure	3-27
3-8-2-3	Select Video Format, PAL or NTSC	3-29
3-8-3	Optional Peripherals/Peripheral Connection	3-32
3-8-3-1	Approved On-board Peripherals	3-32
3-8-3-2	Off-board Peripherals	3-32
3-8-6	Software Options Configuration	3-33

3-8-1 Vivid 7 / Vivid 7 PRO Configuration

3-8-1-1 Log on to the system

Table 3-11 Log on to the system

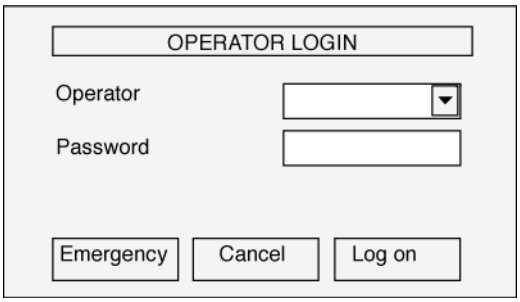
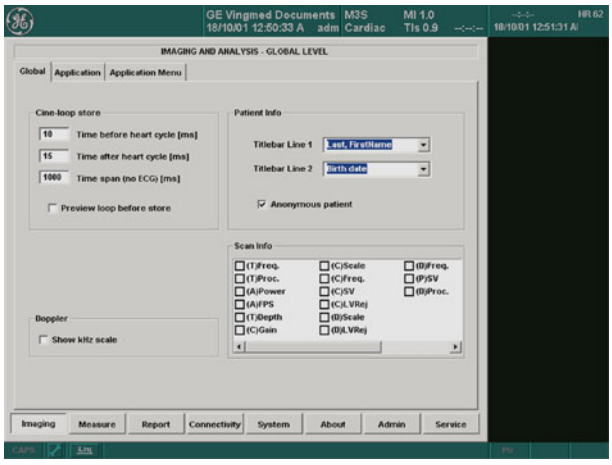
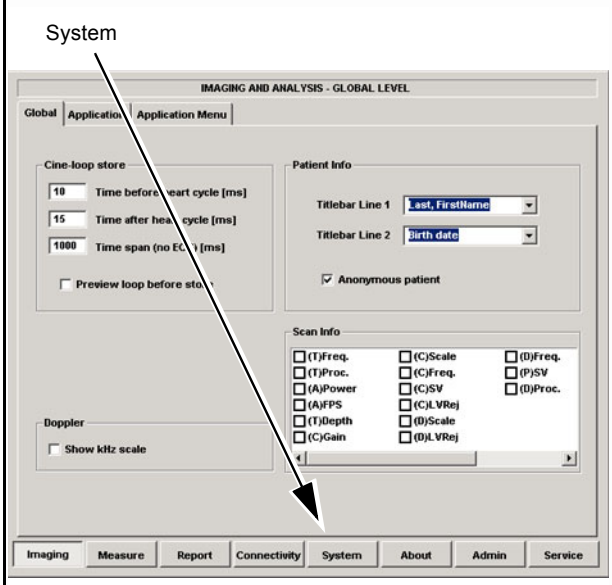
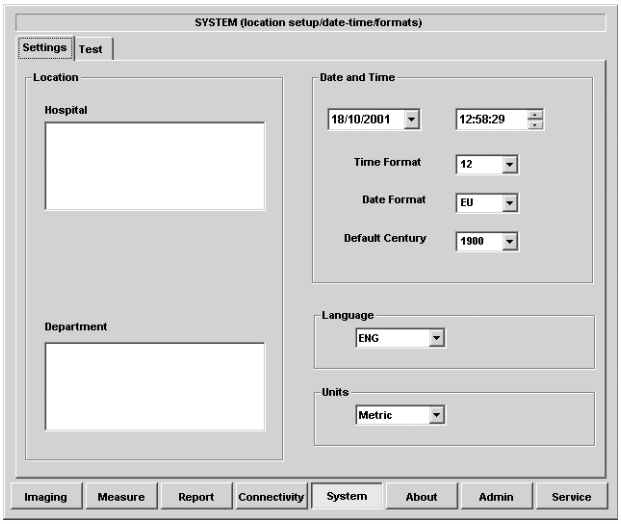
Step	Task	Expected Result(s)
1.	Press **CONFIG** on the alphanumeric keyboard.	The Operator Login window is displayed. 
2.	Click the down-arrow to the right of the Operator field to view the Operator pull down list From the factory, these two users are defined without password. - adm - usr It is possible for the administrator (*adm*) to establish unique passwords for each user, but don't do it now.	
3.	Select the user *adm*. - From the factory, the password has been left blank, so first try to log on without any password. - If the log-on fails, you may try to use the password **service**. - As a last resort, contact the hospital's network administrator (or person responsible for the ultrasound unit), and ask for the password. The Emergency button stores data only from current patient examination.	
4.	Click LOG ON.	The "IMAGING AND ANALYSIS - GLOBAL LEVEL" window is displayed. 

Table 3-11 Log on to the system (continued)

Step	Task	Expected Result(s)
5.	Click SYSTEM to select the System Setup window. 	The System Setup window is displayed 

3-8-1-2 Enter Location

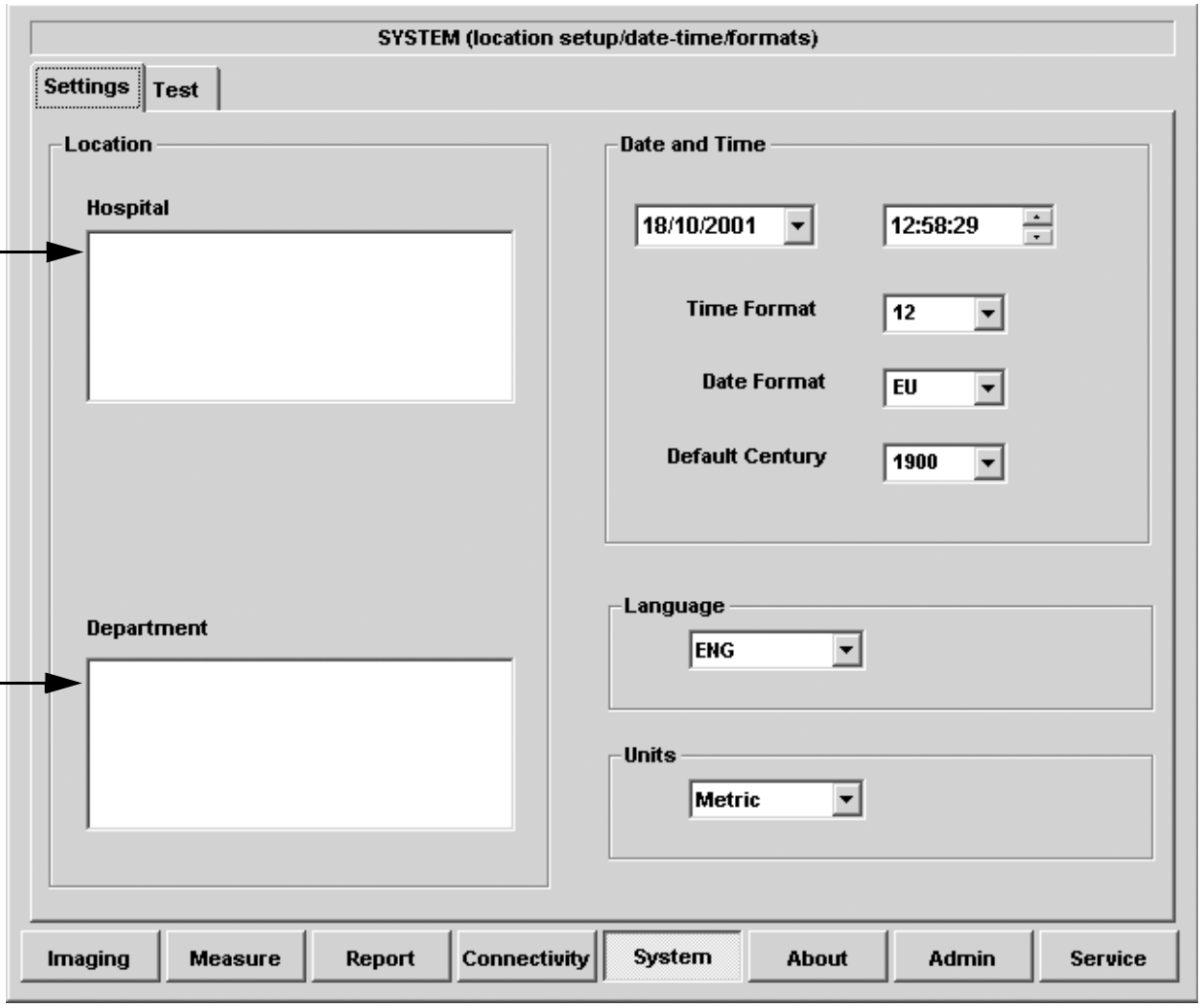


Figure 3-16 Hospital and Department Name

Table 3-12 Location Name

Step	Task	Expected Result(s)
1.	Open the Configuration Window as described in *3-8-1-1 "Log on to the system" on page 3-22*.	*The System Settings Window is displayed.*
2.	Click once in the Hospital field, see (a) in Figure 3-16, and type the name of the hospital (max 64 characters).	The 24 first characters of this name are displayed on the scanning screen's title bar (after restart) All 64 are displayed on the image properties on saved images (after restart).
3.	Click once in the Department field, see (b) in Figure 3-16, and type the name of the department (max 64 characters).	This name will be displayed on the image properties on saved images as soon as the unit has been restarted.

3-8-1-3 Date and Time Adjustments

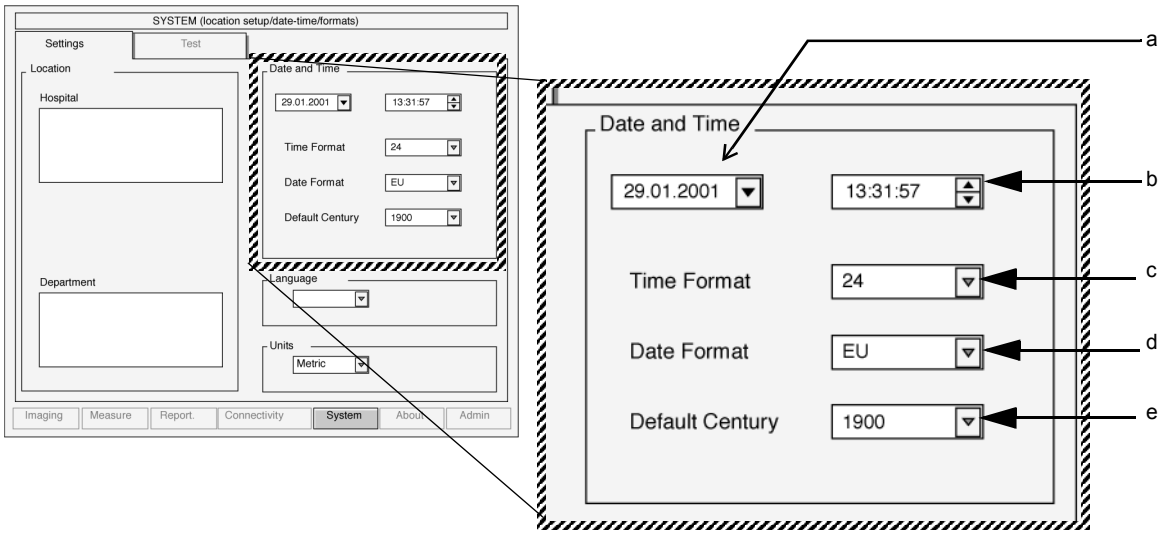


Figure 3-17 Date and Time Adjustments

Table 3-13 Date and Time adjustments

Step	Task	Expected Result(s)
1.	Open the Configuration Window as described in *3-8-1-1 "Log on to the system" on page 3-22*.	*The System Settings Window is displayed.*
2.	Adjust the date, see (a) in Figure 3-17.	New date is displayed
3.	Adjust the time, see (b) in Figure 3-17.	New time is displayed
4.	Select the preferred Time Format, see (c) in Figure 3-17.	**24:** the 24 hour format is used **12**: the 12 AM/PM hour format is used
5.	Select the preferred Date Format, see (d) in Figure 3-17. DD = Date (two digits) MM = Month (two digits) YYYY = Year (four digits)	**EU:** the European “DD.MM.YYYY” format is used **US:** the American “MM.DD.YYYY” format is used
6.	Select Default Century (1900, 2000 or None), see (e) in Figure 3-17.	**1900:** the number **19** is automatically displayed when entering the year in the patient date of birth. To edit century, press **BACKSPACE** twice. **2000:** the number **20** is automatically displayed when entering the year in the patient date of birth. To edit century, press **BACKSPACE** twice. **None:** the four digits have to be typed when entering the year in the patient date of birth. The selected setting will be used as soon as the unit has been restarted.

3-8-1-4 Language Selection

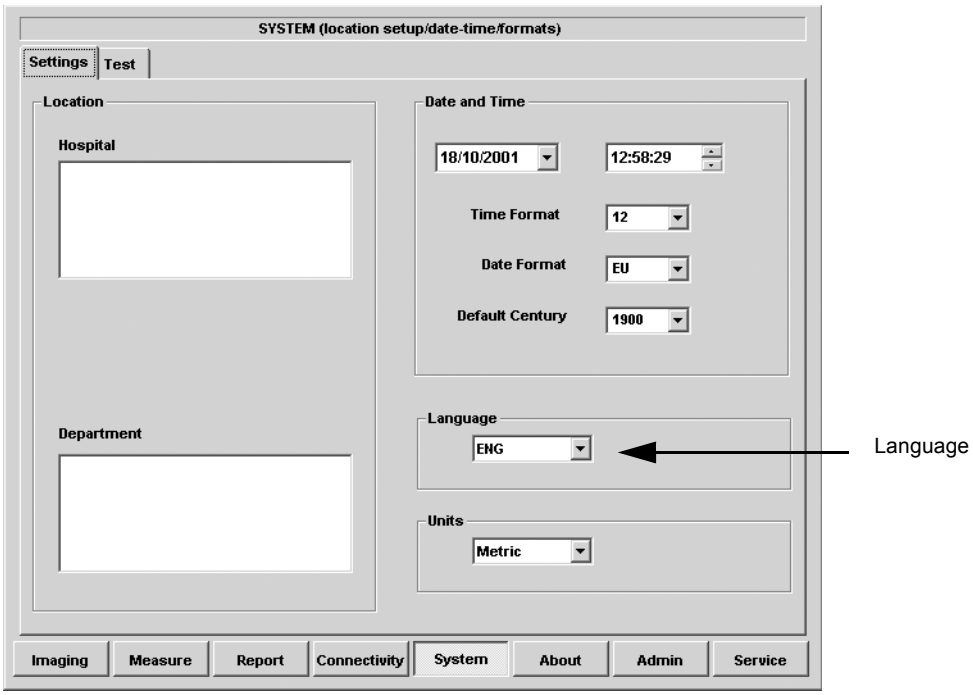


Figure 3-18 Language Selection

Table 3-14 Language Adjustments

Step	Task	Expected Result(s)
1.	Open the Configuration Window as described in *3-8-1-1 "Log on to the system" on page 3-22*.	*The System Settings Window is displayed.*
2.	Use the Language drop down dialog, see Figure 3-18, to select your preferred language for the on-screen interface. The following languages are available; - ENG - English - NOR - Norwegian - DEU - German - ITA - Italian - FRA - French - ESP - Spanish - RUS - Russian - GRE - Greek - DAN - Danish - SWE - Swedish	The selected language will be used as soon as the unit has been restarted.

3-8-1-5 Units of Measure

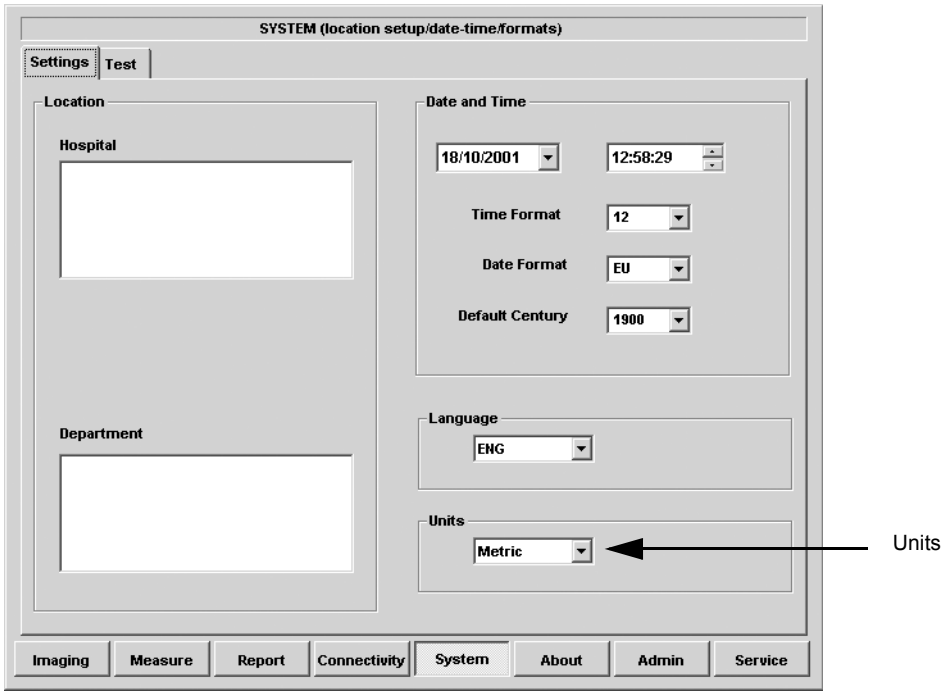


Figure 3-19 Select Units of Measure

Table 3-15 Select Units of Measure

Step	Task	Expected Result(s)
1.	Open the Configuration Window as described in *3-8-1-1 "Log on to the system" on page 3-22*.	*The System Settings Window is displayed.*
2.	Use the drop down dialog to select Metric or US Units.	The selected units (Metric or US) will be used for measurements as soon as the unit has been restarted.
3.	Restart the scanner.	All the changed settings will be used after the restart.

3-8-2 Service Screen

3-8-2-1 Overview

The Service Screen gives you access to;

- select Video Format to be used by VCR
- select VCR type
- adjust LCD's Contrast and Backlight Intensity
- Keyboard Setups
- Printer Setup

3-8-2-2 Open Service Screen

1.) Press **CONFIG**

2.) Select the user *adm.*

*NOTE: From the factory, the password has been left blank, so first try to log on without any password. If the log-on fails, you may try to use the password **service**. As a last resort, contact the hospital's network administrator (or person responsible for the ultrasound unit), and ask for the password.*

3.) Click LOG ON

4.) Click SERVICE to view the Service Screen, see Figure 3-20 on page 3-28.

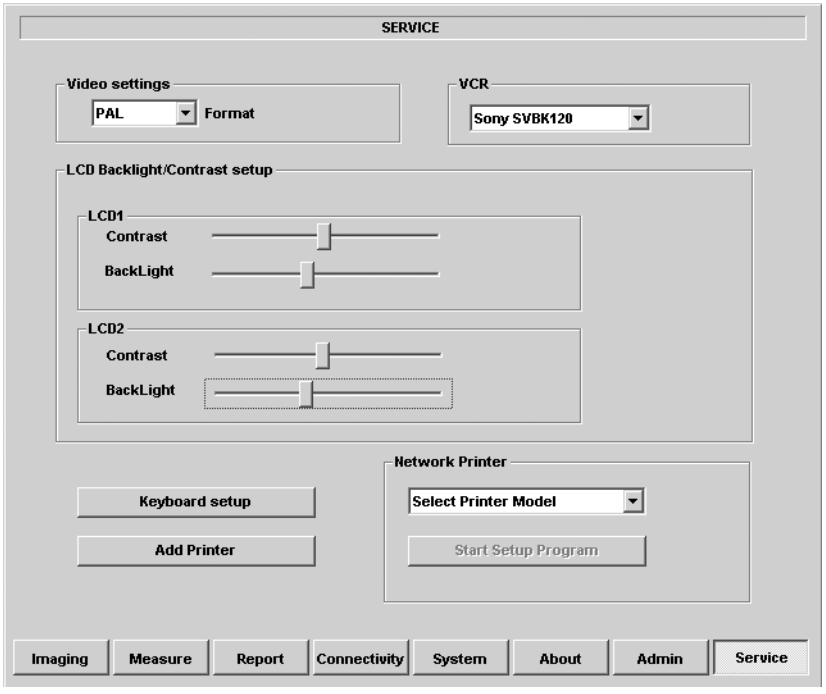


Figure 3-20 Service Screen

3-8-2-3 Select Video Format, PAL or NTSC

This selection must correspond to the Video Standard (PAL or NTSC) used by the Video Cassette Recorder.

From the Video Settings drop-down menu, select the correct video format (NTSC or PAL).

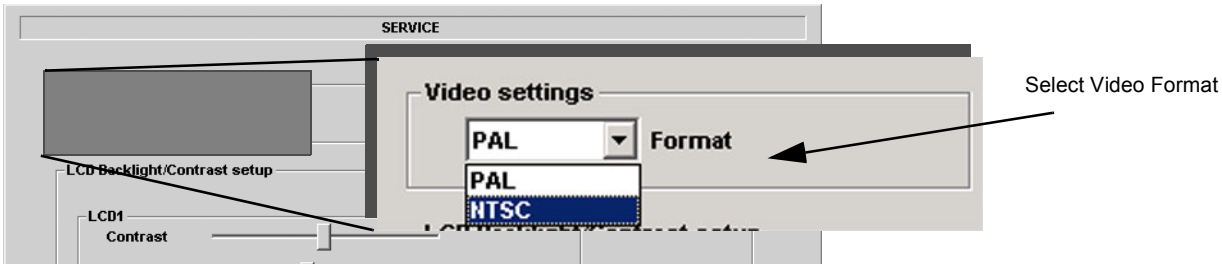


Figure 3-21 Select Video Format

3-8-2-4 Select Video Cassette Recorder (VCR) Type

Use the VCR drop down menu to select VCR type. See "Approved On-board Peripherals" on page 3-32 for approved VCRs for use with Vivid 7 / Vivid 7 PRO.

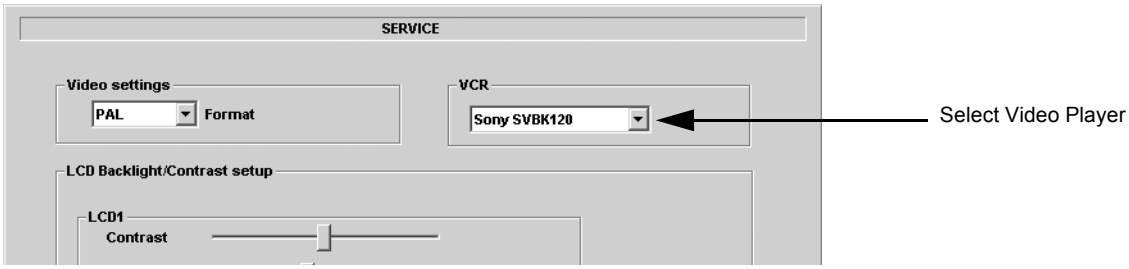


Figure 3-22 Select Video Player

3-8-2-5 Adjust LCDs Contrast and Backlight Intensity

Use the LCD Backlight/Contrast controls to adjust LCD Contrast and LCD Backlight Intensity.

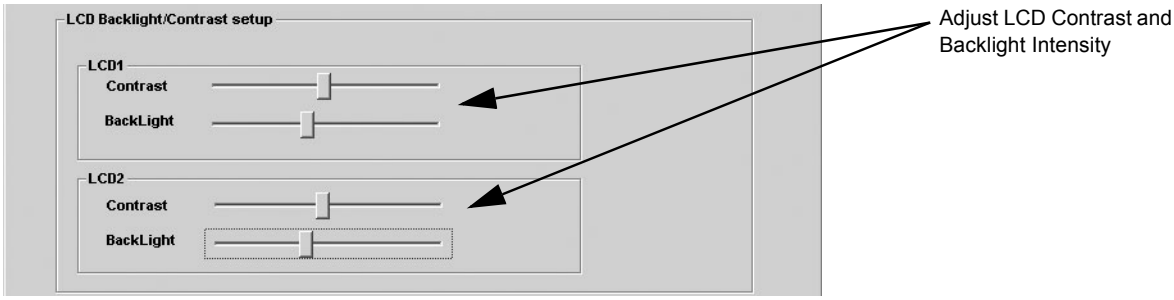


Figure 3-23 Adjust LCD's Contrast and Backlight Intensity

3-8-2-6 Keyboard Setup

Click KEYBOARD SETUP to get access to Keyboard Properties

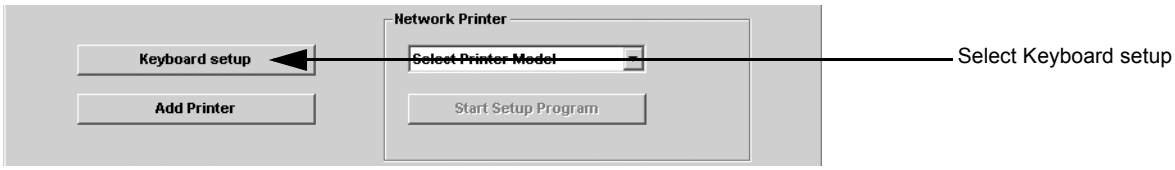


Figure 3-24 Select Keyboard Setup

The Keyboard Properties window has controls for:

- Character Repeat delay
- Character Repeat Rate
- Cursor Blink Rate

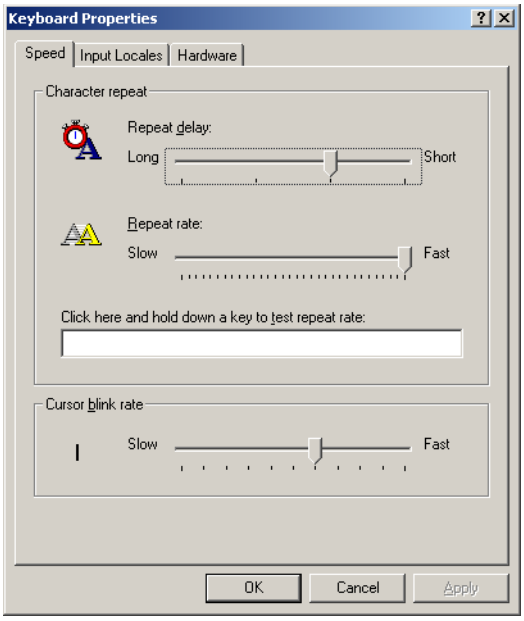


Figure 3-25 Select Keyboard Properties

3-8-2-7 Add Printer

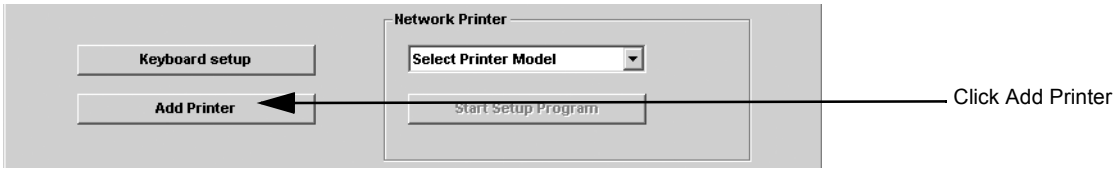


Figure 3-26 Select Add Printer

Click ADD PRINTER to start the Add Printer (Installation) Wizard.


Add Printer Wizard
Welcome to the Add Printer Wizard
This wizard helps you install a printer or make printer connections.
To continue, click Next.
< Back
Next >
Cancel

Figure 3-27 Add Printer Wizard

Follow the instructions in the Wizard to install a new printer.

3-8-3 Optional Peripherals/Peripheral Connection

3-8-3-1 Approved On-board Peripherals

The following list covers the on-board peripherals available for Vivid 7 / Vivid 7 PRO

- Printer, Black & White, Video, Sony
- Printer, Color, Video, Sony, both PAL and NTSC versions are available
- VCR, Panasonic, both PAL and NTSC versions are available
- MO Drive (part of Backend Processor)
- CD-R Drive (part of Backend Processor)

⚠ **NOTICE** Vivid 7 / Vivid 7 PRO supports CD-R discs. CD-RW discs are not supported.

3-8-3-2 Off-board Peripherals

These printers are connected via TCP/IP Network

- Color Inkjet Printer, HP Deskjet 990 Cxi Network Printer (Option)
  (This printer replaces the EPSON 980N printer, see below)

  Detailed delivery checkout and installation coverage of the printer is found in “HP Deskjet 990 Cxi Network Printer Installation Manual”, Part Number EP194422.

  The printer is available in two versions:

  - EP100422, 110 VAC
  - EP100423, 220 VAC
- Color Inkjet Printer, EPSON 980N (Option).
  Installation Instructions for this printer can be found in the “EchoPAC PC Service Manual”, Part Number EP091298

3-8-4 Available Probes

See *Section 9-17 - Probes on page 9-28.*

3-8-5 Video Specification

See *Section 5-12 - Video Specifications on page 5-95*.

3-8-6 Software Options Configuration

3-8-6-1 Software Option Installation

3-8-6-1-1 Prerequisite

Password (Software Option Key)

A Password enables the software option or combination of software options. This password is specific for each Vivid 7 / Vivid 7 PRO.

3-8-6-2 On site Configuration

1.) Press Config (*See "Log on to the system" on page 3-22.* for detailed description)
2.) Select the user *adm*
3.) Click LOG ON
4.) Click SERVICE
5.) Click ADMIN

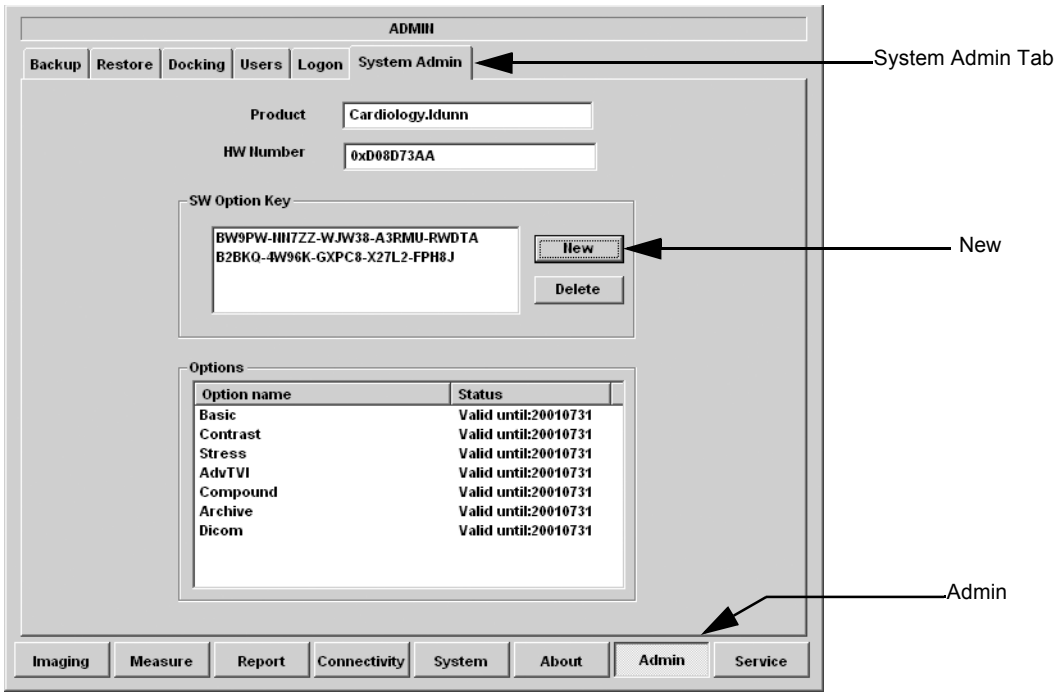


Figure 3-28 Admin Screen

3-8-6-2 On site Configuration (cont'd)

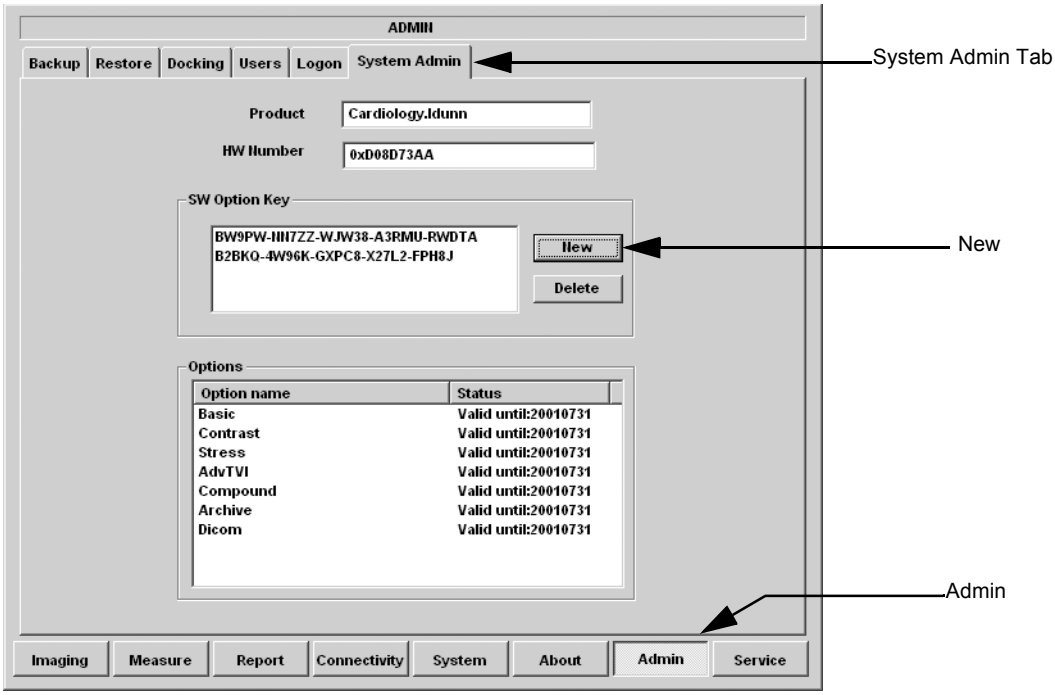


Figure 3-29 Admin Screen

6.) Click the SYSTEM ADMIN tab
7.) Click NEW

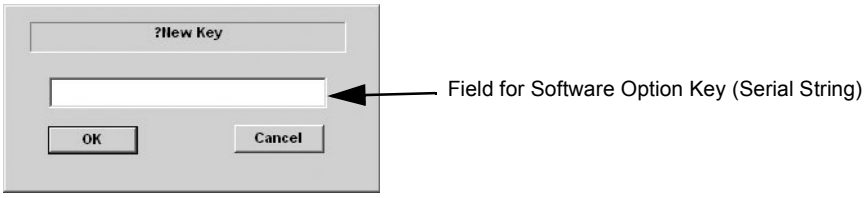


Figure 3-30 Software Option Key

CAUTION **Incorrect password entry will result in loss of system options.**
If password is incorrect, please contact your local GE Service representative.

8.) Type the Password (Software Option Key).
9.) Press OK to save the new setting.
10.) Close the Config window.

3-8-6-3 Remote Check and Configuration

N/A

Section 3-9
Connectivity

3-9-1 Introduction

The next pages describes how to connect the Vivid 7 / Vivid 7 PRO to a remote archive/work station or a DICOM service, using a TCP/IP connection.

Major subjects discussed in this section;

- "Physical Connection" on page 3-35
- "Connectivity Setup" on page 3-37

3-9-2 Physical Connection

3-9-2-1 Ethernet Switch Connections

An Ethernet Switch, Part Number: 066E0741, is used to connect Vivid 7 / Vivid 7 PRO to an EchoPAC PC and a network printer.



Figure 3-31 Ethernet Switch Identifications

:

Table 3-16 MDI Button Position Descriptions

Position	Label	Function
	X To PC	To connect an end station or a Server to the Port
	= To HUB	To connect a HUB or another Switch to the Port

3-9-2-2 Local Network Connection to EchoPAC PC Workstation

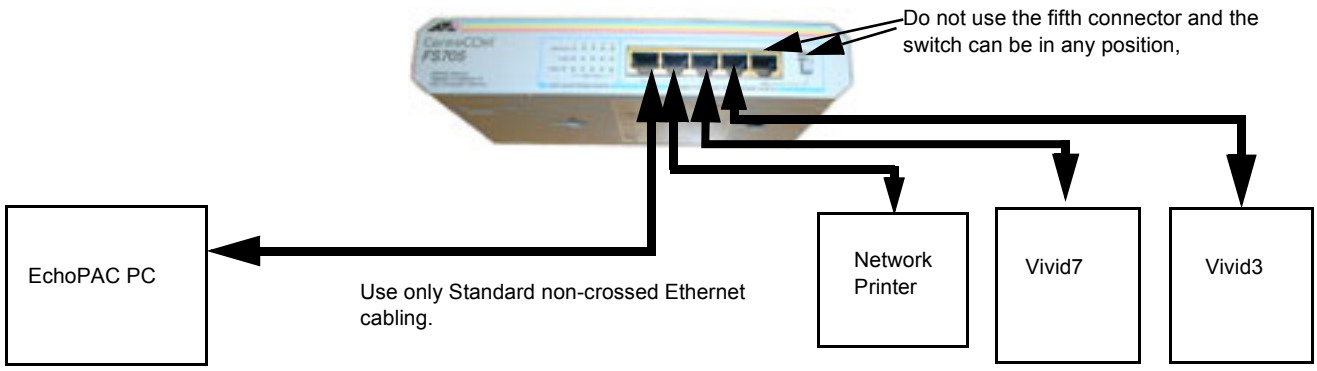

Do not use the fifth connector and the switch can be in any position,
EchoPAC PC
Use only Standard non-crossed Ethernet cabling.
Network Printer
Vivid7
Vivid3

Figure 3-32 Local Network Connection

3-9-2-3 Hospital Network Connection to EchoPAC PC Workstation

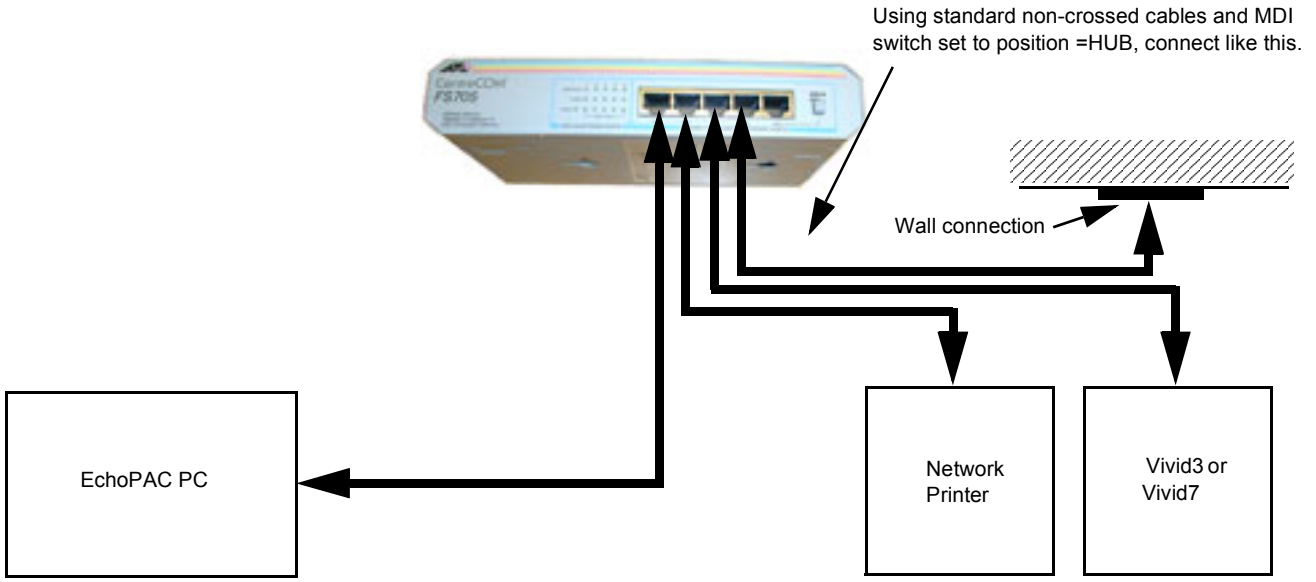

Using standard non-crossed cables and MDI switch set to position =HUB, connect like this.
Wall connection
EchoPAC PC
Network Printer
Vivid3 or Vivid7

Figure 3-33 Hospital Network Connections

See the EchoPAC PC Service Manual, Part Number EP091298 for details about EchoPAC PC, and its set-up.

3-9-3 Connectivity Setup

NOTE: If connected as a stand-alone network (only scanner, EchoPAC PC work station and eventually a network printer in a separate network), you should use default delivery settings.

3-9-3-1 Introduction

To be able to use the network functions when connected to a hospital network, the scanner must have a proper network address.

- Before you can set up the scanner, you need to collect some information. The "Worksheet for DICOM Network Information" on page 2-11 can be used for gathering this information. Typically source for this information is the network administrator.
- Follow the steps below to prepare the scanner for use on the network.

3-9-3-2 Select TCP/IP Set-up Screen

1.) Press **CONFIG** on the Control Panel and log on as *adm* (see page 18).

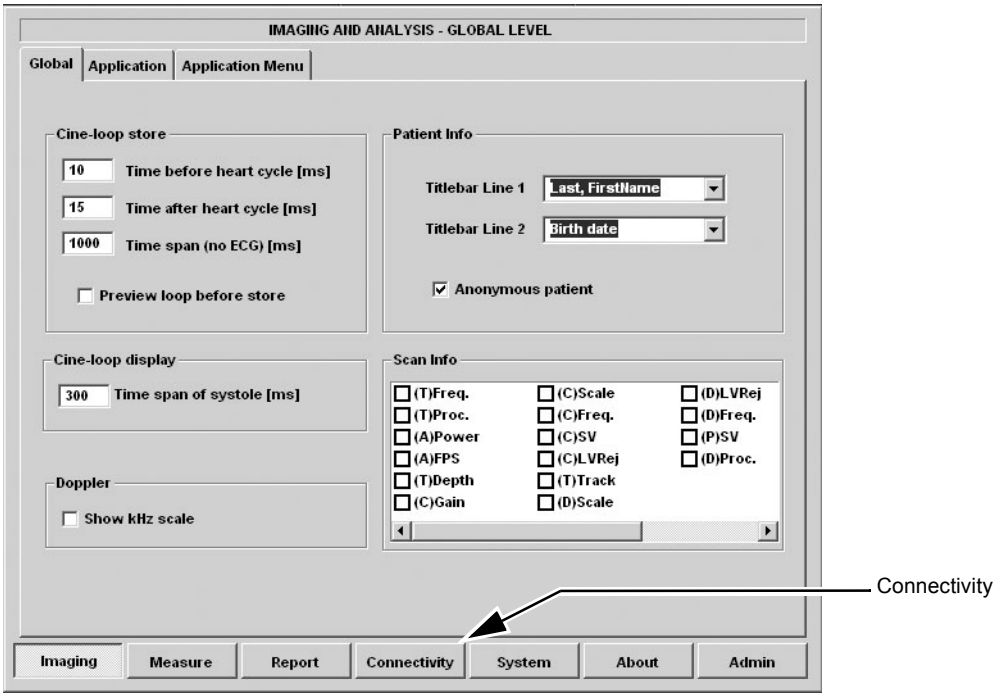


Figure 3-34 Measuring and Analyzes - Global Level

3-9-3-2 Select TCP/IP Set-up Screen (cont'd)

2.) Select CONNECTIVITY (in the lower part of the window)

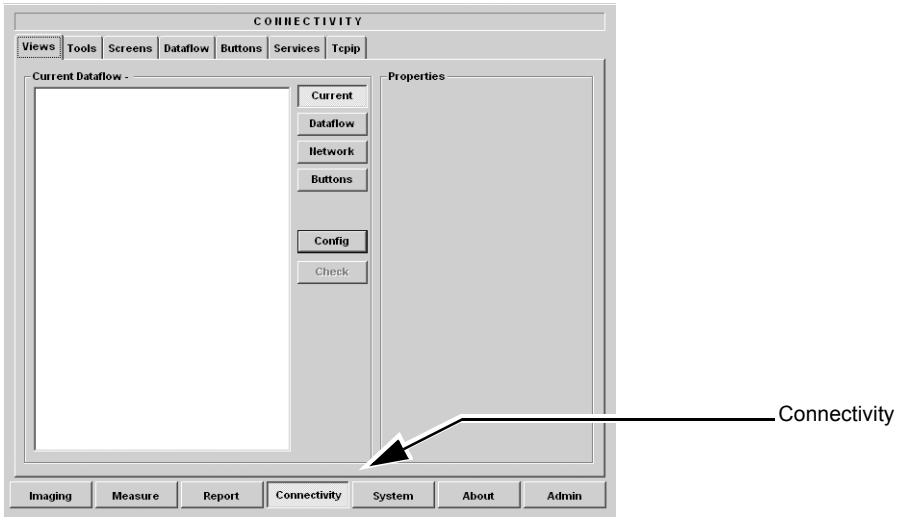


Figure 3-35 Connectivity Opening Screen

3.) Select the TCP/IP TAB (it is named Tcpip). (See example in Figure 3-36.).

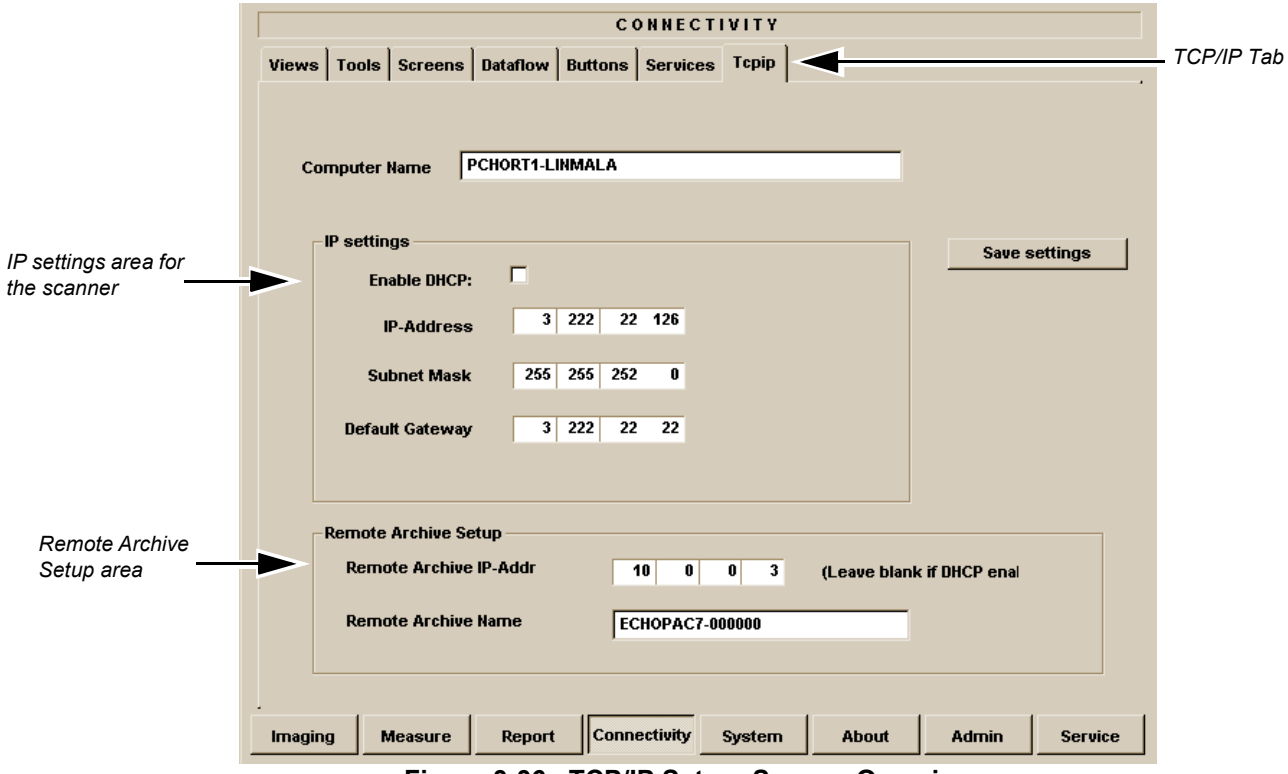


Figure 3-36 TCP/IP Set-up Screen, Overview

3-9-3-3 Set the Scanner's Network Information

In the IP settings area of the screen, enter the;

- IP address for scanner. Default IP address from factory: 10.0.0.3
- Subnet Mask for scanner
- IP address for Default Gateway

NOTE: Do not enable DHCP. The use of DHCP is not supported.

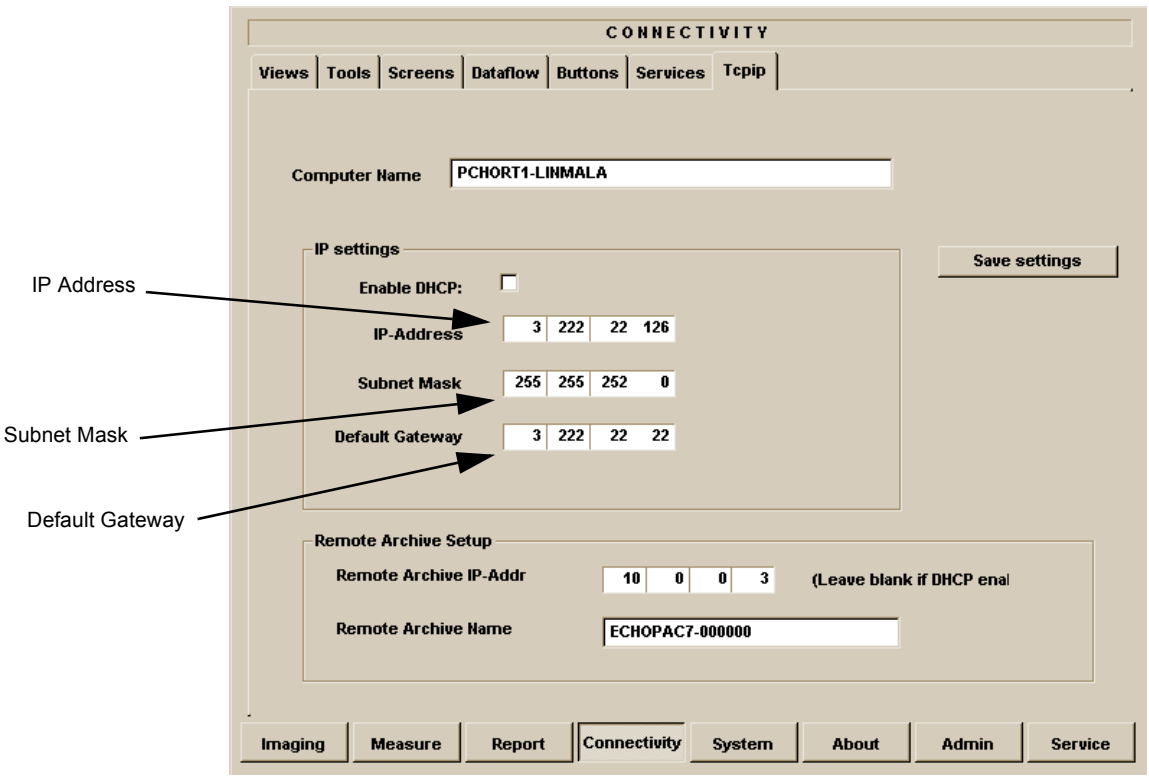


Figure 3-37 TCP/IP Set-up for Vivid 7 / Vivid 7 PRO

3-9-3-4 Set the Remote Archive's Network Information

In the Remote Archive Setup area of the screen (see example in Figure 3-36.), enter the;

1.) Remote Archive IP address
2.) Remote Archive Name

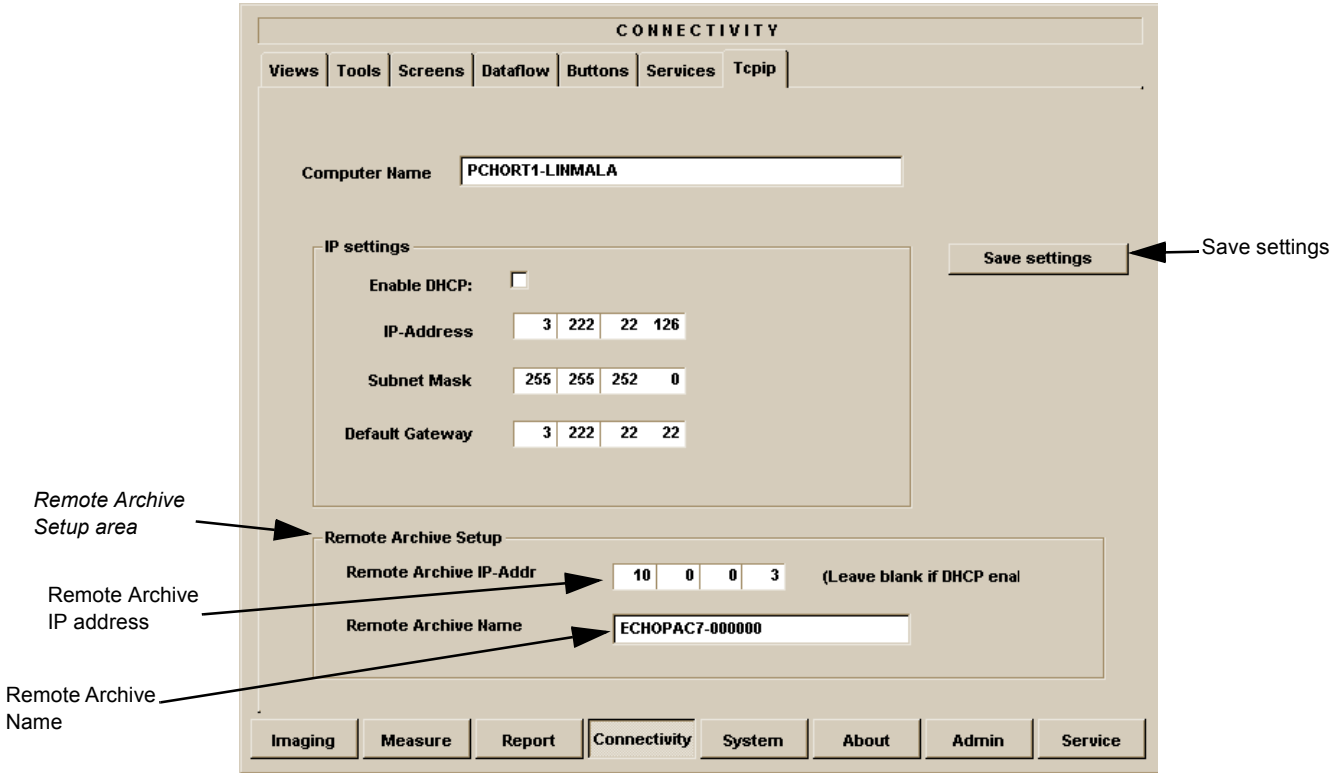


Figure 3-38 TCP/IP Set-up for Remote Archive (EchoPAC PC)

3-9-3-5 Save the New Settings

1.) Press SAVE SETTINGS to save the new settings.

The new settings are saved to a common settings file. After a restart, the settings are also included in other screens.

2.) Restart Vivid 7 / Vivid 7 PRO to make the changes take place.

3-9-3-6 Verification of a Connection Set Up to an EchoPAC PC Work Station

1.) Press **CONFIG** on the Control Panel and log on as *adm* (see "Vivid 7 / Vivid 7 PRO Configuration" on page 3-22).

2.) Select CONNECTIVITY (in the lower part of the window)

3.) Click on the VIEWS tab, located in upper part of window, to display the Current Dataflow Views screen, see Figure 3-39.

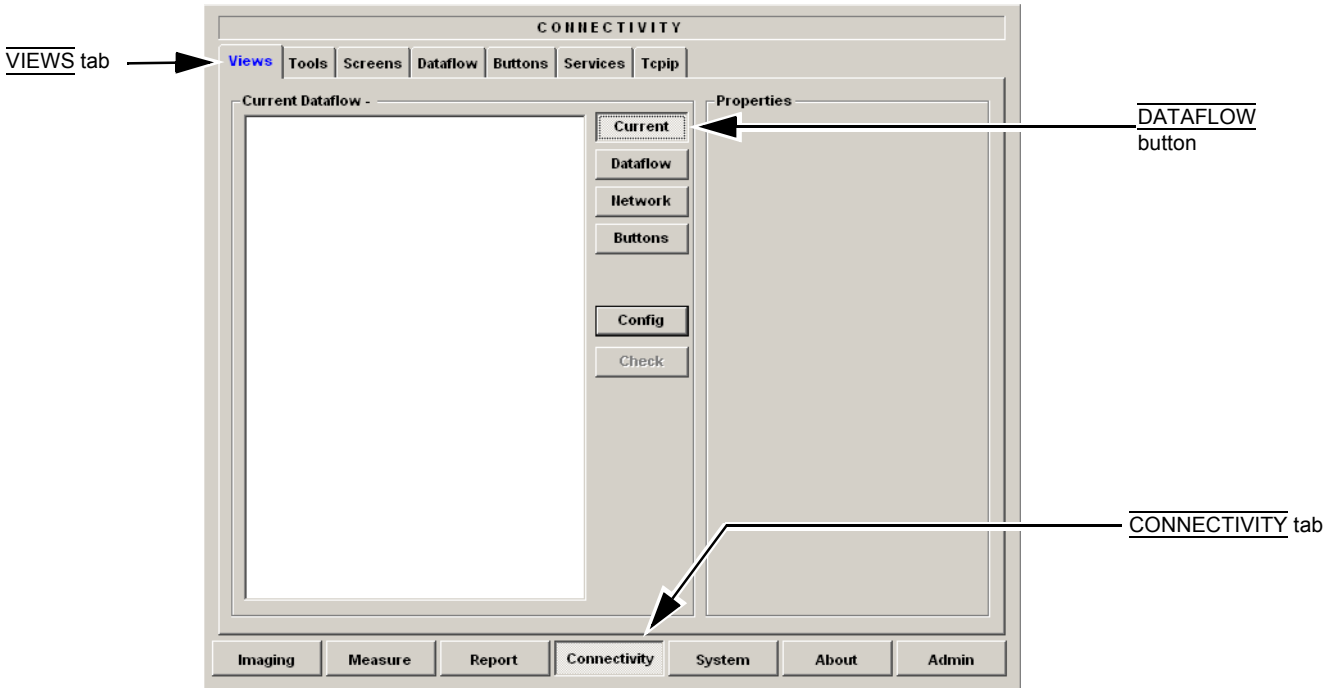


Figure 3-39 Current Dataflow Views screen

4.) Click the DATAFLOW button to see all available data flows, see Figure 3-40.

5.) Click the + beside the dataflow you want to check (here: *Remote Archive - Remote HD*) to see its contents.

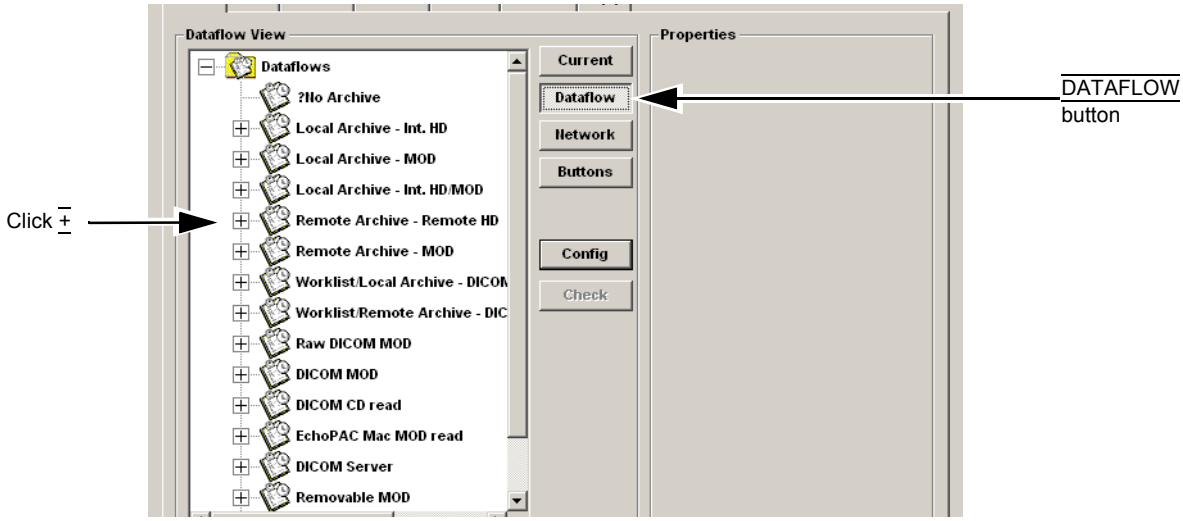


Figure 3-40 Pre-configured Data flows in Vivid 7 / Vivid 7 PRO

3-9-3-6 Verification of a Connection Set Up to an EchoPAC PC Work Station (cont'd)

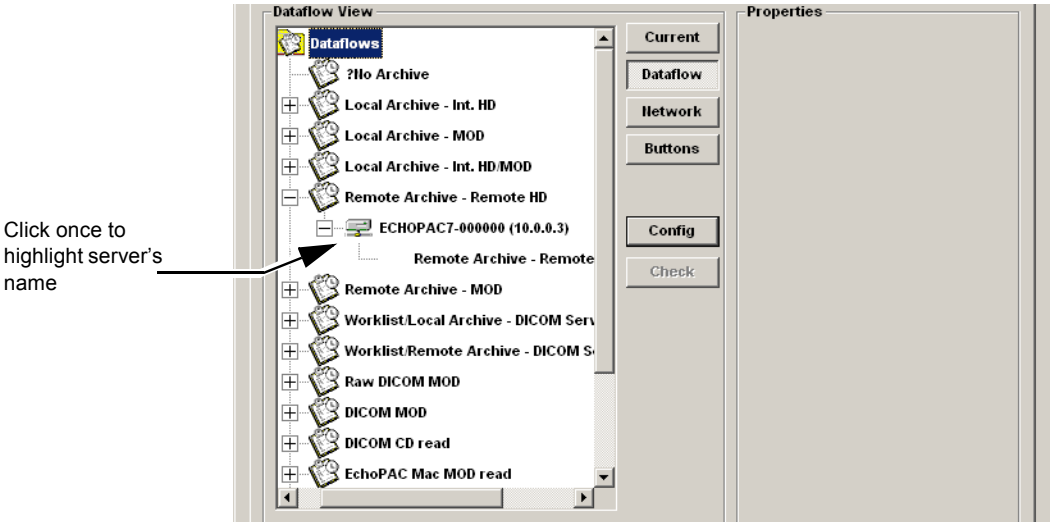


Figure 3-41 Remote HD dataflow contents

The Remote Archive - Remote HD includes an EchoPAC PC with one Service also called *Remote Archive - Remote HD*. The name of this service indicates that the archive is located on a hard disk on a remote server (EchoPAC PC is used as an server).

6.) Click once on the EchoPAC PC's name to highlight it, see Figure 3-41.

7.) Click CHECK, see *Figure 3-42*, to verify if there is a connection between the ultrasound unit and the EchoPAC PC work station.

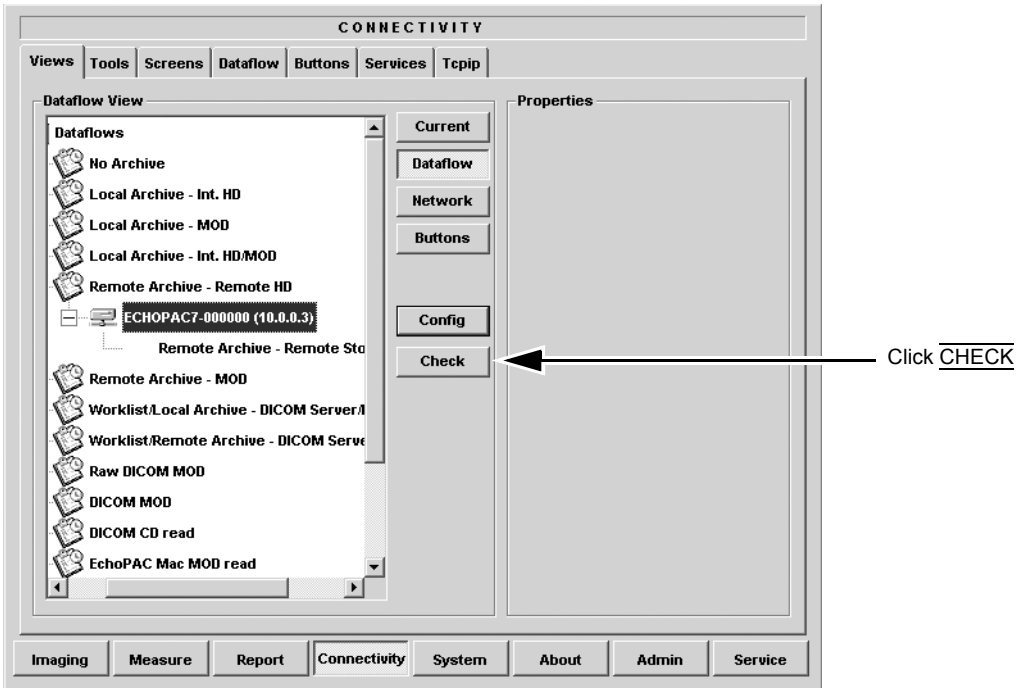


Figure 3-42 Verify dataflow connection

3-9-3-6 Verification of a Connection Set Up to an EchoPAC PC Work Station (cont'd)

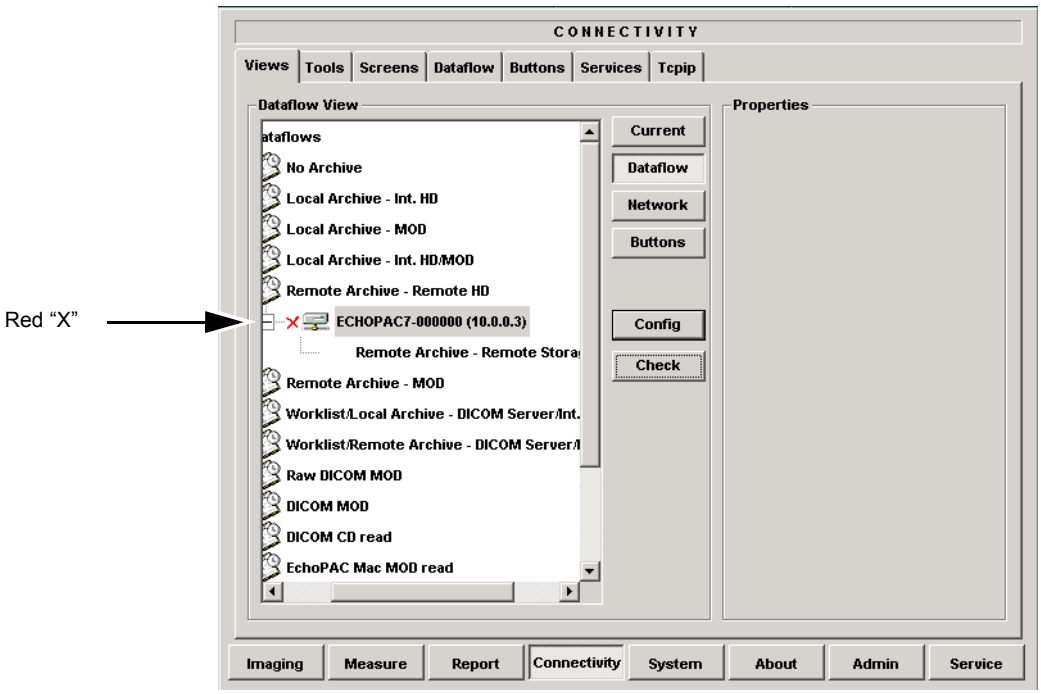


Figure 3-43 Verification of connection failed

- In the example in Figure 3-43, the red "X" next to the computer sign (×🖳), means that the check failed. The cause may be;
  - the setup of the network information, either on Vivid 7 / Vivid 7 PRO or on the EchoPAC PC, or
  - the network connection is broken somewhere between the Vivid 7 / Vivid 7 PRO and the EchoPAC PC.
- A green light next to the computer sign means that a network connection is in place.

3-9-3-6 Verification of a Connection Set Up to an EchoPAC PC Work Station (cont'd)

8.) Click the DATAFLOW tab to view the Dataflow Services window.

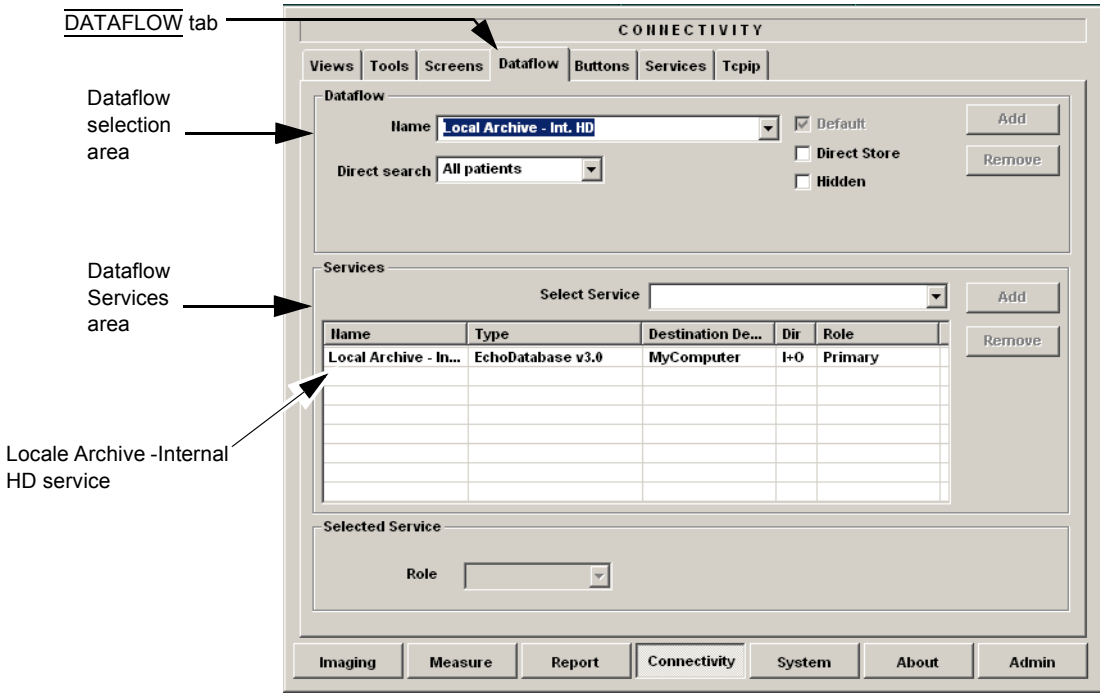


Figure 3-44 Dataflow Services Window

9.) Select *Remote Archive - Remote HD* on the drop-down menu to see the contents of that dataflow.

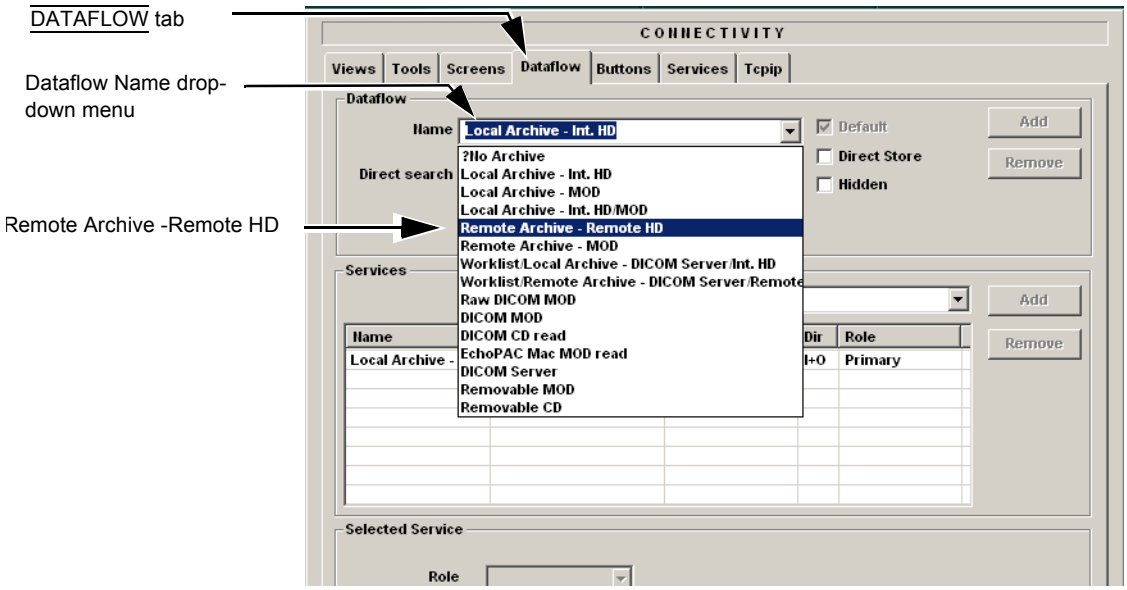


Figure 3-45 Obtaining Dataflow Contents Overview

3-9-3-6 Verification of a Connection Set Up to an EchoPAC PC Work Station (cont'd)

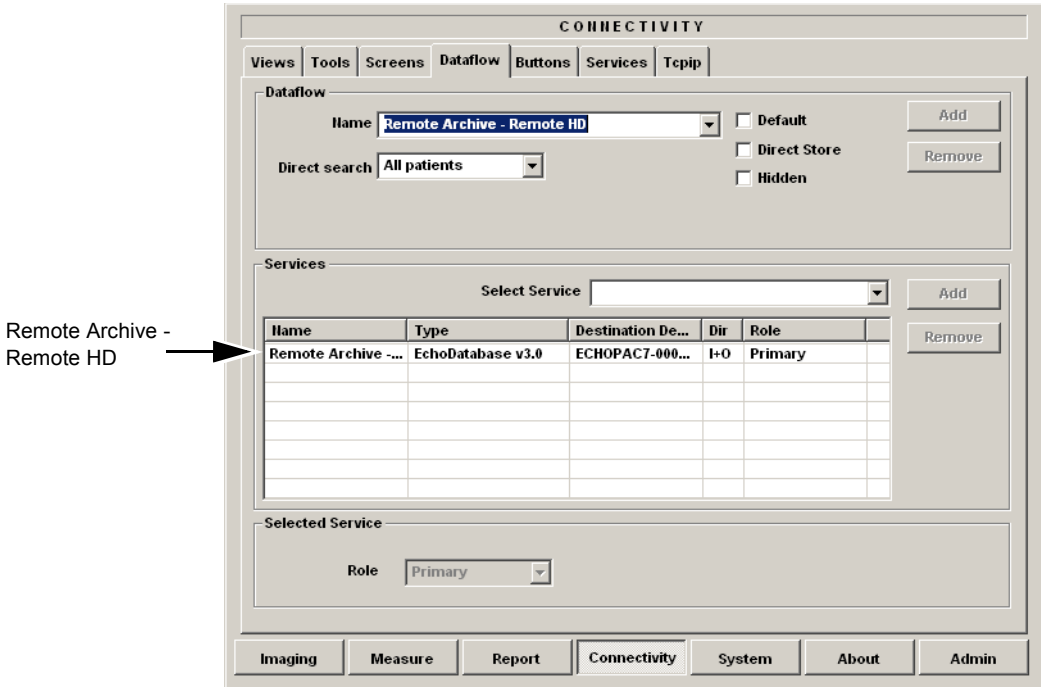


Figure 3-46 Remote Archive - Remote HD Dataflow Contents Overview

3-9-3-6 Verification of a Connection Set Up to an EchoPAC PC Work Station (cont'd)

10.) Select the SERVICES tab (located near the top of the window).

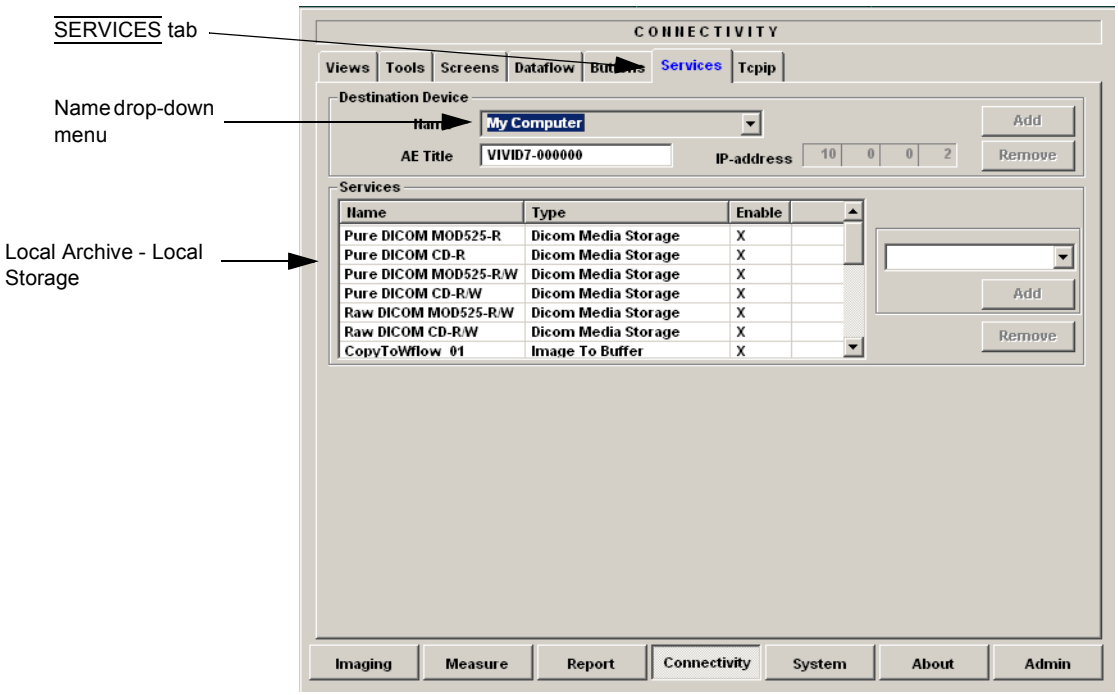


Figure 3-47 Dataflow Services

11.) Select the EchoPAC PC work station you want to connect to, from the "Name" drop-down menu. In this example, it is called "EchoPAC7-000000".

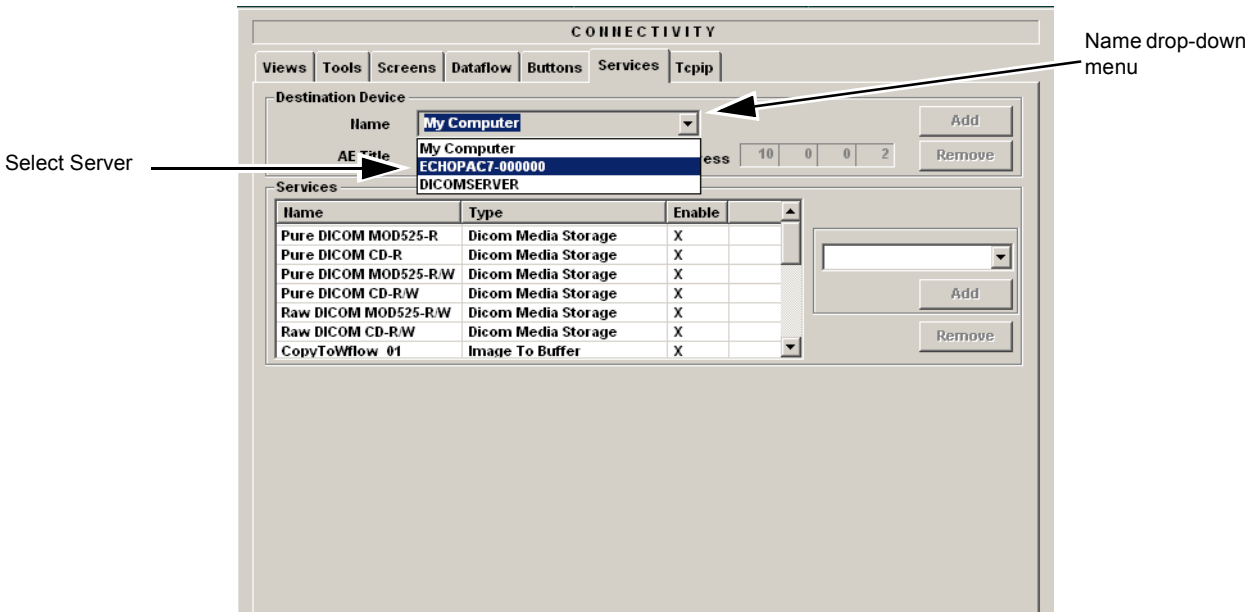


Figure 3-48 Dataflow Services, Choices and Setup

3-9-3-6 Verification of a Connection Set Up to an EchoPAC PC Work Station (cont'd)

12.) Verify that the IP-address is correct, indicating that you have selected the right unit.
If the IP number is wrong, it means that you are addressing the wrong device (computer).
Correct the address and do a new verification before you continue.

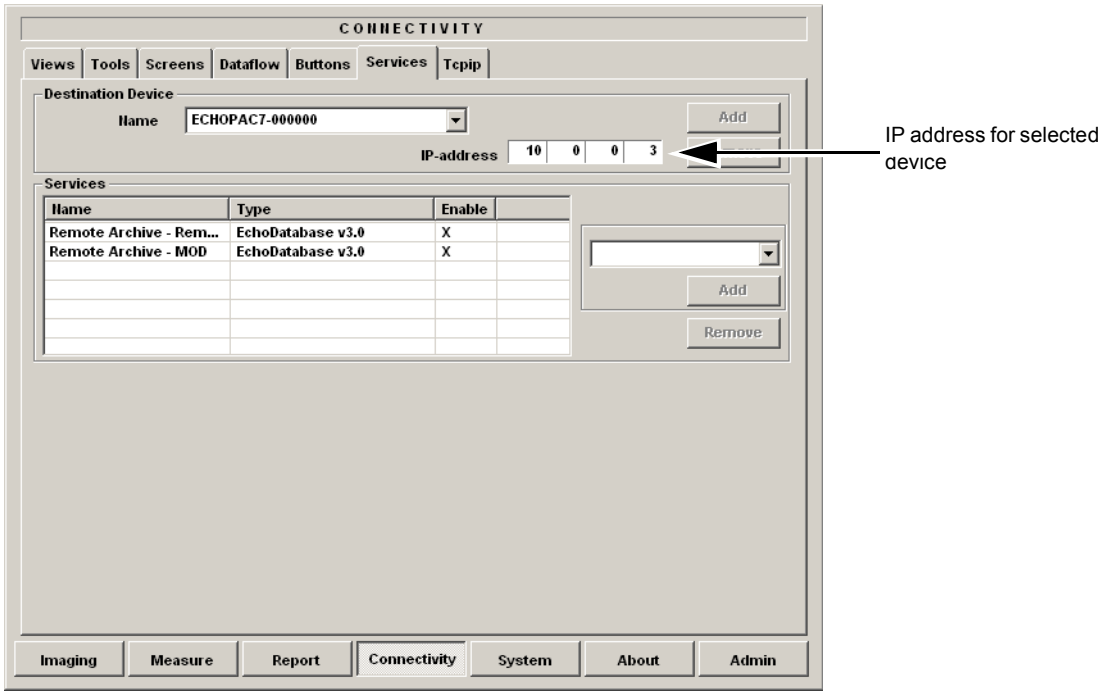


Figure 3-49 Verify/change IP address to selected device.

3-9-3-6 Verification of a Connection Set Up to an EchoPAC PC Work Station (cont'd)

13.) In the list of "Services", select "Remote Archive - Remote Storage".

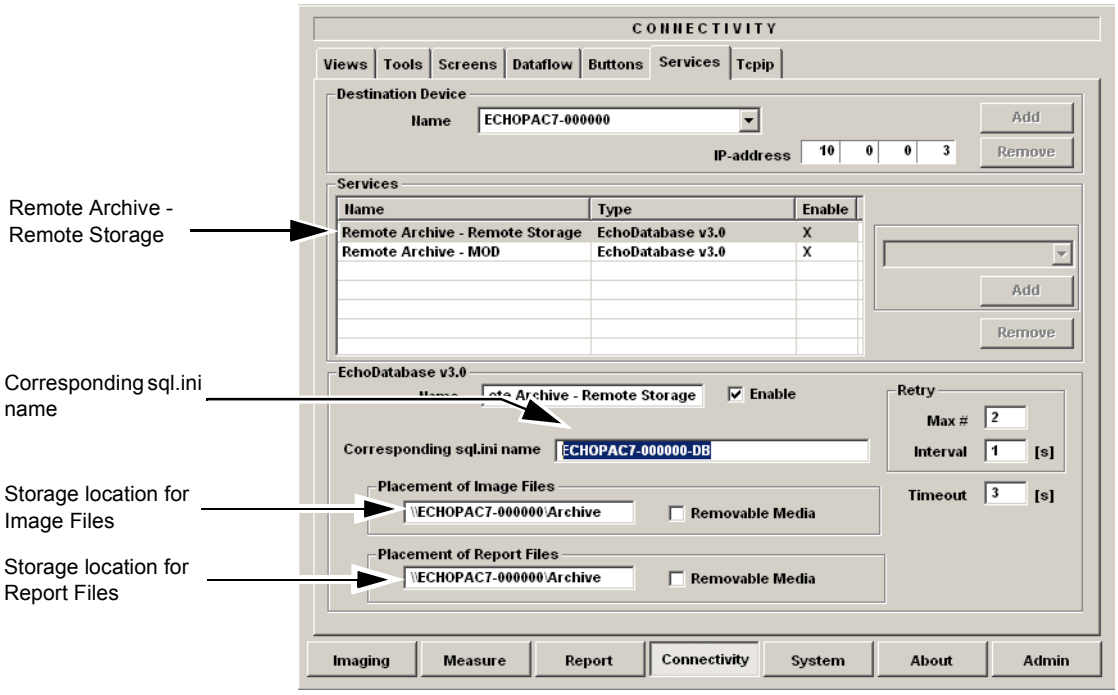


Figure 3-50 Dataflow Service Choice and Setup

14.) In the list of *Services* select *Remote Archive - Remote Storage*.

15.) Change the *Corresponding sql.ini name* to reflect the name of the ECHOPAC7-nnnnnn work station. The *Corresponding sql.ini name* is a combination of the host name plus a space and the two letters "DB".

Example: If the EchoPAC PC name is *ECHOPAC7-987654*, the *Corresponding sql.ini name* will be *ECHOPAC7-987654 DB*

16.) Change the *Placement of Image Files* and *Placement of Report Files* names so they reflect the name of the EchoPAC PC work station.

Example: If the EchoPAC PC name is *ECHOPAC7-987654*, the *Placement of Image Files* and *Placement of Report Files* are both *ECHOPAC7-987654\Archive*

This completes the EchoPAC PC connection setup.

NOTE: Remember that these settings have no effect until you have logged on to the dataflow. It may be necessary to log on and log off this dataflow before the settings work.

3-9-3-7 Set Up Connection to a DICOM Server in a Network

No special service tools are required to do this set-up.

3-9-3-7-1 Preparations

Obtain the following information from the network administrator:

- DICOM server's IP address, subnet mask (and gateway, if required)
- Server's Port Number
- Server's AE Title
- IP address for the Vivid 7 / Vivid 7 PRO

3-9-3-7-2 Establish Network Connection to Hospital's Network (if not already established)

Connect an Ethernet cable from the Vivid 7 / Vivid 7 PRO to the wall network outlet.

3-9-3-7-3 Set up TCP/IP address on Vivid 7 / Vivid 7 PRO

1.) Set up TCP/IP address on Vivid 7 / Vivid 7 PRO. (*See "Connectivity Setup" on page 3-37.*)

a.) Select **CONFIG**
b.) Log on as *adm*
c.) Click CONNECTIVITY
d.) Click TCPIP tab
e.) Enter IP-Address, Subnet Mask (and gateway, if required).
f.) Click SAVE SETTINGS. You will be asked to reboot, but wait with that until later.

3-9-3-7-4 DICOM Server's Set Up

It may be necessary for the administrator to enter information about Vivid 7 / Vivid 7 PRO into the DICOM server's set-up.

This information is typically Vivid 7 / Vivid 7 PRO's AE Title and maybe also the IP address which he provides.

(See Vivid 7 / Vivid 7 PRO's AE Title on next page for a description on how to obtain Vivid 7 / Vivid 7 PRO's AE Title.)

3-9-3-7 Set Up Connection to a DICOM Server in a Network (cont'd)

3-9-3-7-5 Vivid 7 / Vivid 7 PRO's AE Title

1.) Select CONNECTIVITY

2.) Click on the SERVICES tab.

Vivid 7 / Vivid 7 PRO's AE Title is listed below My Computer (here it is VIVID7-000000).

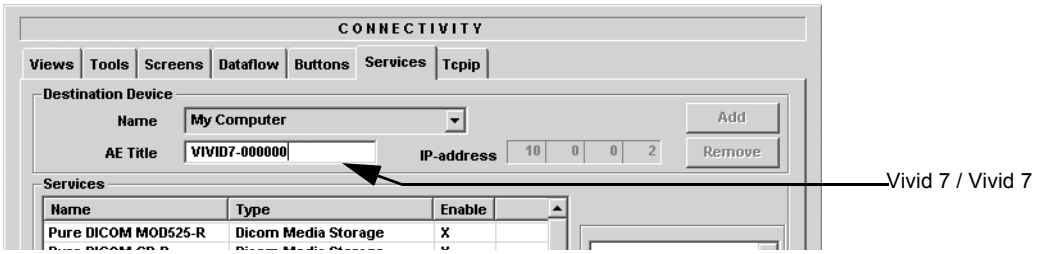


Figure 3-51 Vivid 7 / Vivid 7 PRO's AE Title

3-9-3-7-6 Set-up of DICOM Server in Vivid 7 / Vivid 7 PRO's Configuration Screens

1.) From the Name pull-down menu select DICOMSERVER.

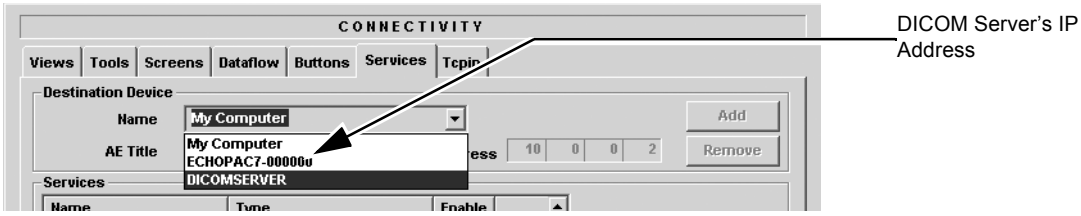


Figure 3-52 Select DICOM Server

2.) Enter the IP address of the DICOM server in the IP Address field.

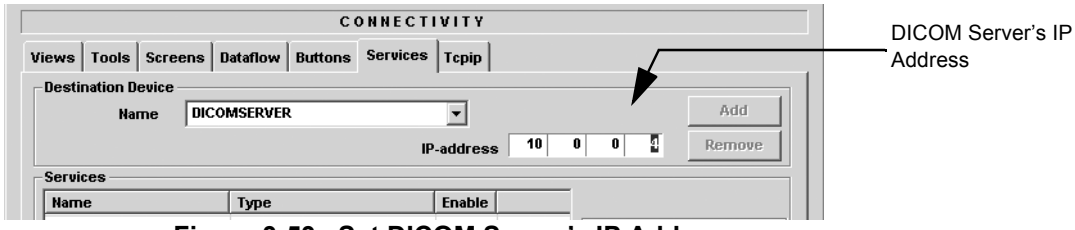


Figure 3-53 Set DICOM Server's IP Address

3-9-3-7 Set Up Connection to a DICOM Server in a Network (cont'd)

3-9-3-7-6 Set-up of DICOM Server in Vivid 7 / Vivid 7 PRO's Configuration Screens (cont'd)

3.) Click once on the Pure DICOM Storage line under Services and the bottom part of the screen will be populated with set-up information for the DICOM server.

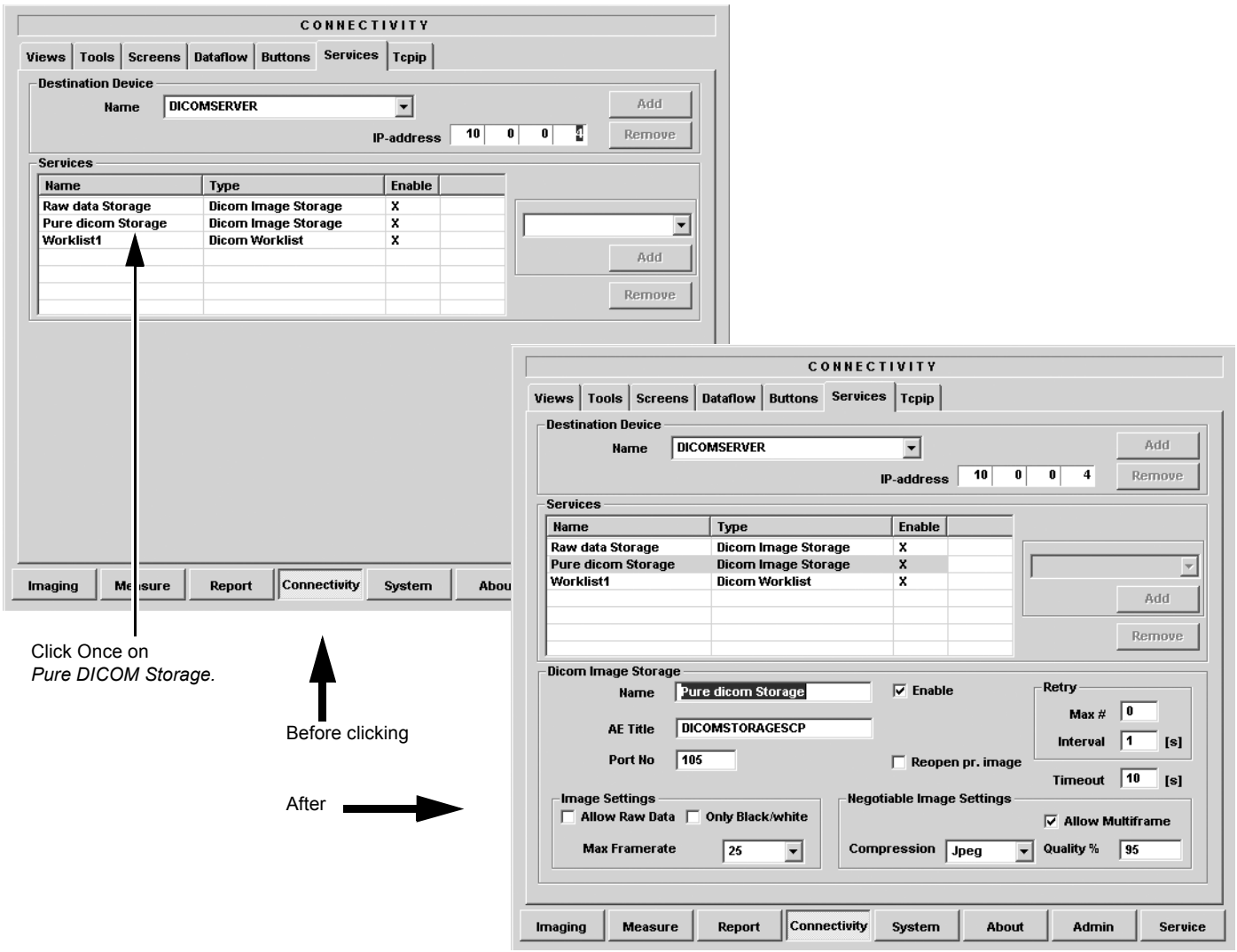


Figure 3-54 Click Once on *Pure DICOM Storage*

3-9-3-7 Set Up Connection to a DICOM Server in a Network (cont'd)

3-9-3-7-6 Set-up of DICOM Server in Vivid 7 / Vivid 7 PRO's Configuration Screens (cont'd)

4.) Change the Name to a name you pick for the DICOM server (e.g. ProSolv server). It doesn't really matter what this name is.

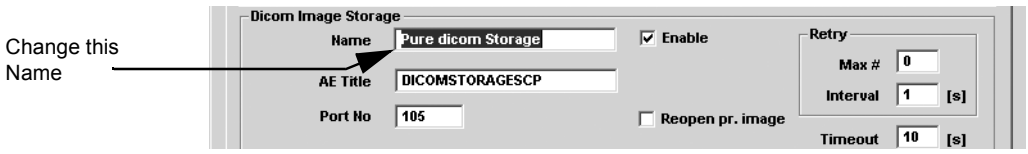


Figure 3-55 Set DICOM Server's Name

5.) Change the AE Title to the name you got from the network administrator. This name must match exactly and is case sensitive.

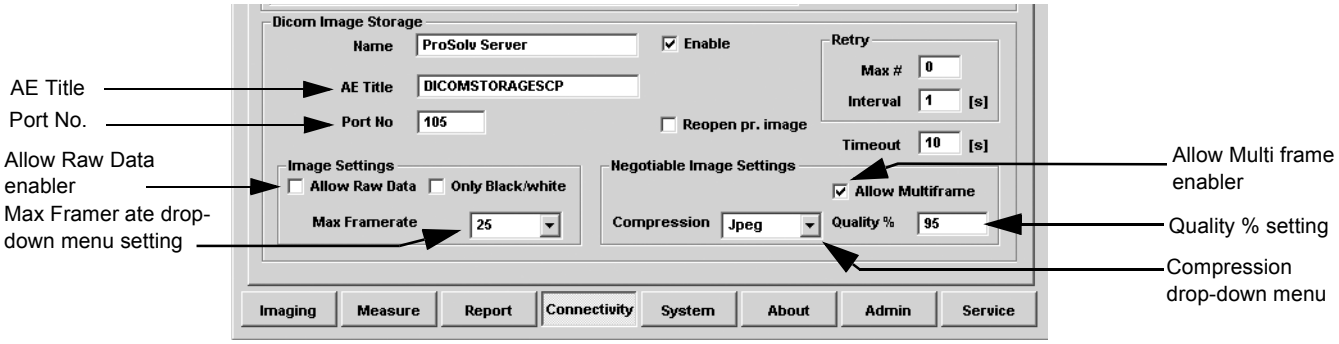


Figure 3-56 DICOM Server's Settings

6.) Change the port number to the number you got from the administrator.

7.) Don't touch the other settings, meaning they should be as follows:

Parameter	Setting	Comments
Allow raw data	Unchecked	
Max Framerate	25	You can go up to 30, but don't select full, as it may increase Image Store time
Only Black and White	Unchecked	
Compression	JPEG	
Allow multiframe	Checked	
Reopen per image	Unchecked	

Table 3-17 Default DICOM Setup in Vivid 7 / Vivid 7 PRO's Configuration Screen

8.) Click on the keyboard **CONFIG** button to exit config, and REBOOT the system.

3-9-3-7-7 Check the Connection to the DICOM Server (Ping)

1.) After the system is rebooted, press Config, log on as adm (no password) and enter the Connectivity screen.

2.) Click the VIEWS tab and the DATAFLOW button and you will see all available data flows.

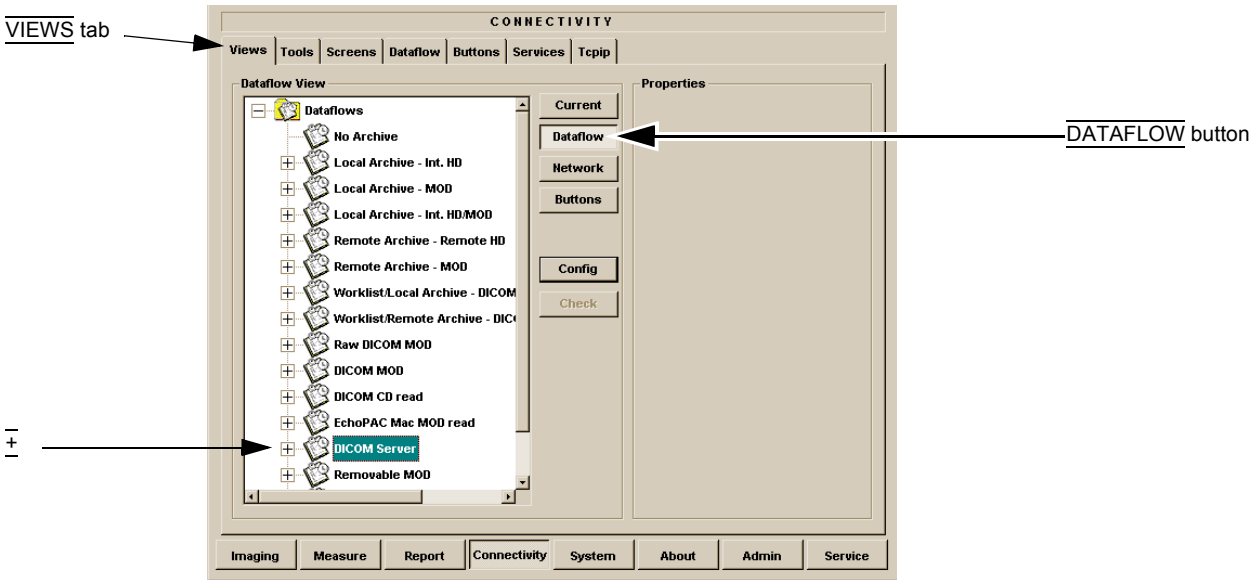


Figure 3-57 All Data flows - Select "DICOM Server"

3.) Click on the + by the "DICOM Server" dataflow to see the contents of that dataflow. This dataflow has one DICOM Server with Storage Service.
Two new lines will appear, DICOMSERVER and the name of the server (e.g. ProSolv server).

..

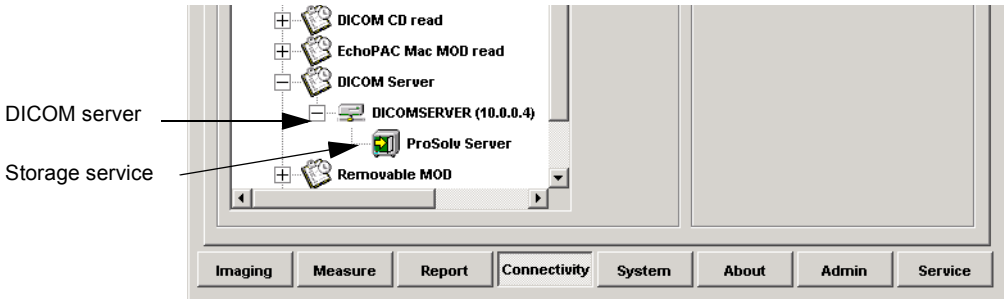


Figure 3-58 Views and Dataflow Selections

4.) Click once on DICOMSERVER to highlight the line, then click on the Check button.
You should get a green check mark.
This is a hardware "ping" indicating that you have contact with the DICOM server's hardware. If you get a red cross, double check cabling and TCPIP addresses).

5.) Click once on the next line (e.g. ProSolv server) to highlight, then click on CHECK.
You should get a green check mark.
This is a DICOM "ping" indicating that you have contact with the DICOM server software. If you get a red cross, double check AE Title and port number).

3-9-3-7-8 Setting the DICOM Server as Default Dataflow

1.) Finnish the verification in "Check the Connection to the DICOM Server (Ping)" on page 3-53. You need to have green check marks on both Hardware Ping and DICOM Ping before you continue.

1.) Click the DATAFLOW tab.

2.) Select “DICOM Server” dataflow on the “Dataflow Name” drop-down menu.

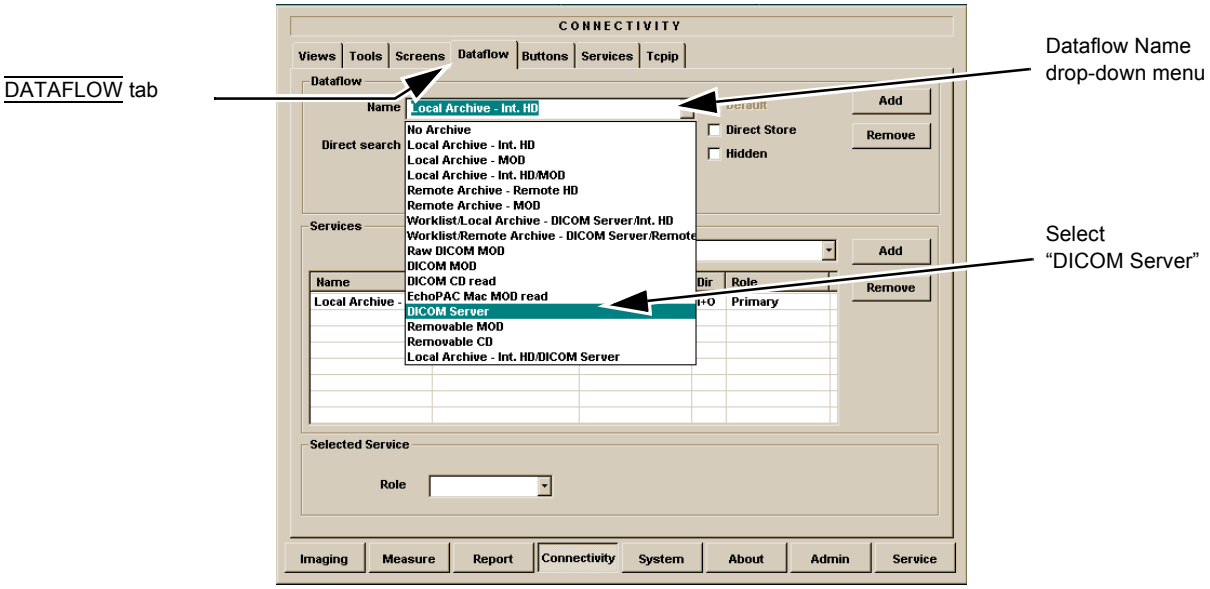


Figure 3-59 Selecting DICOM Dataflow Services

3.) Check the Default box.

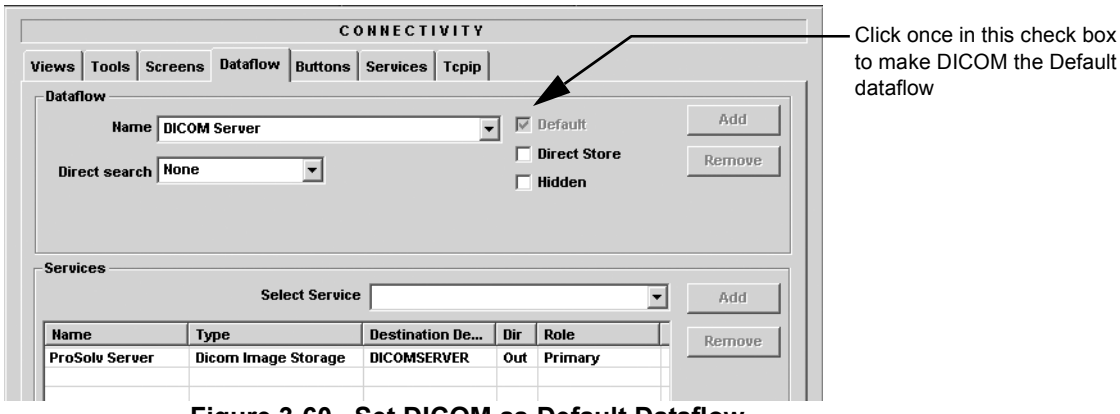


Figure 3-60 Set DICOM as Default Dataflow

4.) Exit Config and restart the scanner (by hitting CTRL-ALT-R at the same time).

3-9-3-7-9 Performing a Study

1.) After restart, hit New Exam (you'll see that DICOM Server is the default dataflow), enter a last name and patient ID and start scanning and image acquisition. Images are stored in the local image buffer on the system.

2.) After having finished the study, click on New Exam and select All when asked if you want to save. The images will now be transferred to the server via a spooler.

3.) To view the status of the spooler job, press the F4 key on the keyboard. You can select the Refresh button to get an update of the status of the spool job.

4.) Once the jobs are transferred, they will be deleted from the spooler.

3-9-3-7-10 Going Offline

1.) If you go offline with the scanner, you can still use the DICOM Server dataflow, and images will be saved into the spooler.

2.) Then, when connecting to the server, go into the spooler and highlight all the studies. Then select SEND TO… and select the server name (e.g. ProSolv server) from the Send to Service and click on SEND. All selected studies will then be sent to the server.

Section 3-10
Installation Paperwork

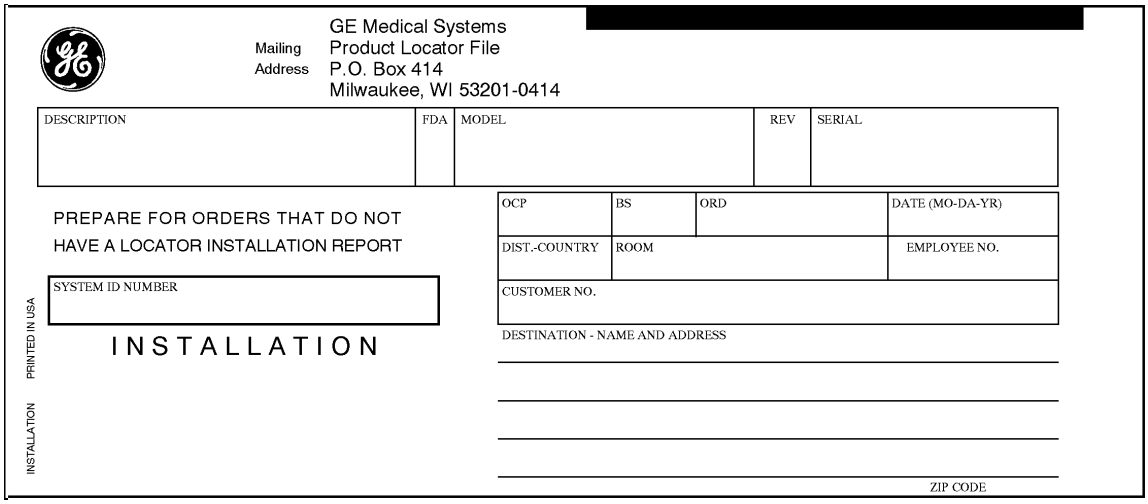
NOTE: During and after installation, the documentation (i.e. User Manuals, Installation Manuals etc.) for the peripheral units must be kept as part of the original system documentation. This will ensure that all relevant safety and user informations are available during the operation and service of the complete system.

3-10-1 User Manual(s)

Check that the correct User Manual(s), per software (sw) revision and language, for the system is included. See section 9-21 on page 9-34 for complete list of User Manuals.

3-10-1-1 Product Locator Installation Card

NOTE: The Product Locator Installation Card shown may not be same as the provided Product Locator card.


GE Medical Systems
Mailing Address
Product Locator File
P.O. Box 414
Milwaukee, WI 53201-0414

DESCRIPTION	FDA	MODEL	REV	SERIAL

PREPARE FOR ORDERS THAT DO NOT HAVE A LOCATOR INSTALLATION REPORT

OCP	BS	ORD	DATE (MO-DA-YR)
DIST.-COUNTRY	ROOM		EMPLOYEE NO.
CUSTOMER NO.			

SYSTEM ID NUMBER

INSTALLATION

DESTINATION - NAME AND ADDRESS

ZIP CODE

PRINTED IN USA

INSTALLATION

Figure 3-61 Product Locator Installation Card

3-10-2 Complete the Post Delivery Check List

Please fill in the enclosed form “Post Delivery Check List” (at the back of this reminder) and fax it to our System Test Department, Fax # +47 3302 1354, as soon as you have powered up and checked the system.This is most important for us to ensure top quality on our delivery. If any deviation according to specifications occurs, the responsible system tester will contact you immediately.

3-10-3 Post Delivery Check List

Fill in your observations and return the check list to:

GE Vingmed Ultrasound
Fax No.: +47 3302 1354
Attention: System Test Department

System tester: _____ (please use BLOCK LETTERS)

Post Delivery Check List for Vivid_____ Serial NO:_____

SUBJECT	OK	NOT OK	COMMENTS
Packing			
Loose screws /Hard Ware			
Overall appearance			
System documents (Followers, cont.lists)			
Functional test			
2D image			
M-Mode			
Doppler spectral			
Color doppler			
Configuration			
Peripherals			
EchoPAC PC			
Probes			
Corrective actions Replaced boards/probes documented by S/N			

Missing parts

Contact and signature

Do you want the responsible system tester to contact you	YES: _____ NO:_____
Sign:	Date: _____ Fax page. _____ of _____

Chapter 4
Functional Checks

Section 4-1
Overview

4-1-1 Purpose of Chapter 4

This chapter provides procedures for quickly checking major functions of the Vivid 7 / Vivid 7 PRO scanner, diagnostics by using the built-in service software, and power supply adjustments.

Table 4-1 Contents in chapter 4

Section	Description	Page Number
4-1	Overview	4-1
4-2	General Procedures	4-2
4-3	Functional Checks	4-14
4-4	Application Turnover Check List	4-63
4-5	Power Supply	4-64
4-6	Site Log	4-65

4-1-2 Special Equipment Required

- An empty (blank) MO Disk;
  - P/N: 066E0490 (1.3 GB)
  - P/N: 066E0519 (5.4 GB)
  - P/N: 066E0514 (8.6 GB)
- ECG Pads
- ECG Harness, CABLE ECG MARQ. AHA/AMERICA, P/N:164L0025
  - CABLE ECG MARQ. AHA/AMERICA, P/N:164L0025
  - LEADWIRES ECG MARQ. AHA/AMERICA, P/N: 164L0027

  or

  - CABLE ECG MARQ. IEC / EU + AS, P/N:164L0026
  - LEADWIRES ECG MARQ. IEC/EU+AS, P/N:164L0028
- At least one probe (ideally you should check all the probes used on the system by the site.) See Probes on page 9-28, for an overview of available probes

Section 4-2
General Procedures

4-2-1 Power ON/ Boot Up

4-2-1-1 Connecting Mains Power to the Unit

DANGER **Never use a three-to-two prong adapter; this defeats the safety ground.**

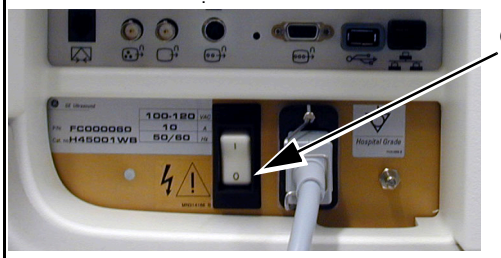
CAUTION **SYSTEM REQUIRES ALL COVERS**

Operate this unit only when all board covers and frame panels are securely in place. The covers are required for safe operation, good system performance and cooling purposes.

NOTE: Do not cycle the Circuit Breaker ON-OFF-ON in less than five -5- seconds. When turning OFF the Circuit Breaker, the system should de-energize completely before turning the circuit breaker ON.

NOTE: When turning on a system from standby mode, it takes a few seconds before it responds. Do not push the On/off button again during this period. A second push will initiate a full shutdown.

Table 4-2 Connecting Mains Power to the unit

Step	Task	Expected Result(s)
1	Connect the female plug on the Power Cable to the Power Inlet at the rear of the unit.	 Clasp OFF
2	Lock the plug in position with the retaining clasp.	The retaining clasp prevent the plug from being unplugged during use.  Clasp ON
3	Verify that the Mains Power Circuit Breaker is in OFF position, eventually switch it OFF.	 OFF Position
4	Connect the other end of the Power Cable (with the male plug) to a hospital grade mains power outlet with the proper rated voltage.	The unit is ready for Power ON/Boot Up.

4-2-1-2 Turn Unit ON

Table 4-3 Turn Unit ON

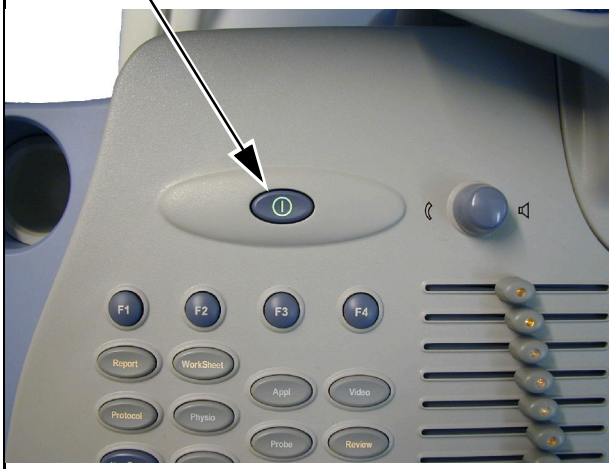
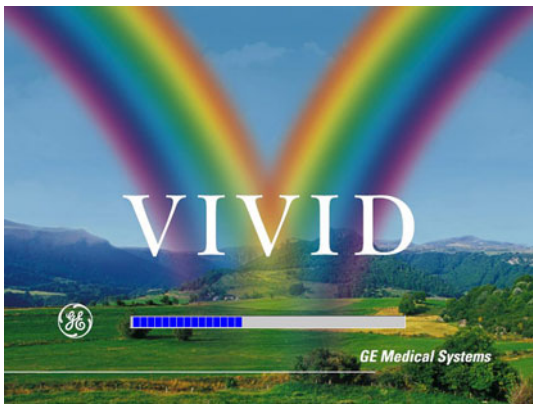
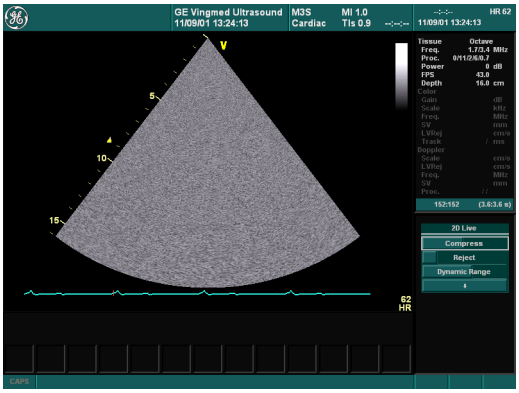
Step	Task	Expected Result(s)
1	Switch ON the Mains Power Circuit Breaker at the rear of the unit. Mains Power Circuit Breaker in ON position 	You will hear a “click” from the relays in the AC Power/AC Controller. The unit is ready for Boot Up.
2	Press the **ON/OFF** key on the Control Panel (Keyboard) once. **ON/OFF** key 	1) The unit’s ventilation fan starts on full speed, but slows down after a few seconds (listen to the fan noise). 2) Power is distributed to the peripherals, Control Panel (Console), Monitor, Card Rack and Backend Processor. 3) Backend Processor and rest of Scanner starts with the following sequence: 4) Backend Processor is turned ON and starts to load the software. 5) The Start Screen (Vivid) is displayed on the monitor 6) A start-up bar is displayed on the monitor, indicating the progress of the software loading.  *NOTE: If the unit has been in the OFF condition for an extended period of time, (3 to 5 days or more), the unit may not boot, or may beep when turned on. See “System Doesn’t Boot” on page 7-67. for more details, including how to recover.*

Table 4-3 Turn Unit ON (continued)

Step	Task	Expected Result(s)
3	Wait for the unit to boot.	The software initiates and set up the Card Rack and the rest of the instrument. The backlight in the keyboard is lit. As soon as the software has been loaded, a 2D screen is displayed on the screen.  Total time used for start-up is typically three minutes.

4-2-2 Power Shut Down

4-2-2-1 Overview

When the unit is switched off, the system performs an automatic shutdown sequence. The unit can be switched off into two states:

- **Standby Mode:**
  Most of the system is powered down, but a certain portion of the unit remains energized. The standby mode allows a shorter reboot time when the system is used on a daily basis or moved from one place to another.
- **Full Shut Down:**
  The entire system is shut down. It is recommended to perform a full shutdown at least once a week.

4-2-2-2 Power Shut Down to Standby Mode

This procedure describes the needed steps to power down the unit to Standby mode:

1.) Press the **ON/OFF** key on the Control Panel once to display the System - Exit menu on the screen.

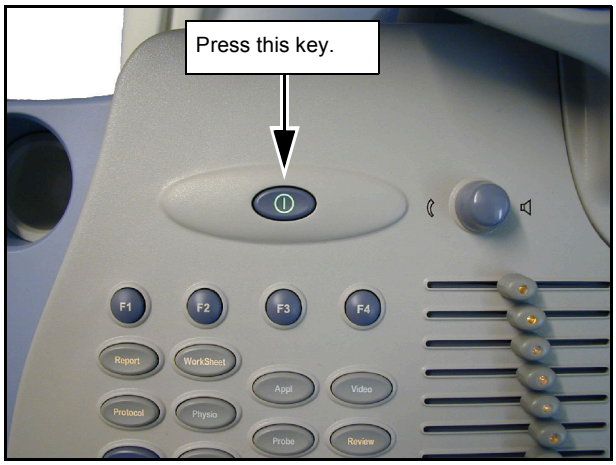


Figure 4-1 Press ON-OFF key once

4-2-2-2 Power Shut Down to Standby Mode (cont'd)

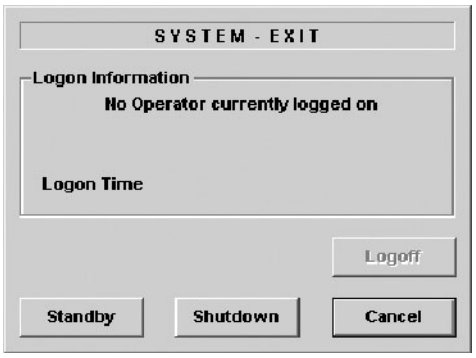


Figure 4-2 System - Exit menu

The System - Exit menu gives you the following choices:

- **Logoff**
  Use this button to log off the current user.
  The system remains on and ready for a new user to log on.
  The dimmed button in Figure 4-2 on page 4-6 indicates that no user is logged on to the unit at the moment.
- **Standby**
  Use this button to select the Standby mode, allowing a shorter reboot time. The next step describes the use of this button.
- **Shutdown...**
  Use this button to Shut Down the system.
- **Cancel**
  Use this button to exit from the System-Exit menu and return to the previous operation.

2.) Click STANDBY to select Standby mode.

If the power cable is removed from the wall outlet the system will remain in Standby mode for approximately 15 minutes. If the system is unplugged for a longer period of time, a full shutdown is automatically performed.

NOTE: When turning on a system from standby mode, it takes a few seconds before it responds. Do not push the On/off button again during this period. A second push will initiate a full shutdown.

4-2-2-3 Full Power Shut Down

This procedure describes the needed steps to do a complete power down of the system:

1.) Press the **ON/OFF** key on the Control Panel once to display the System - Exit menu on the screen.

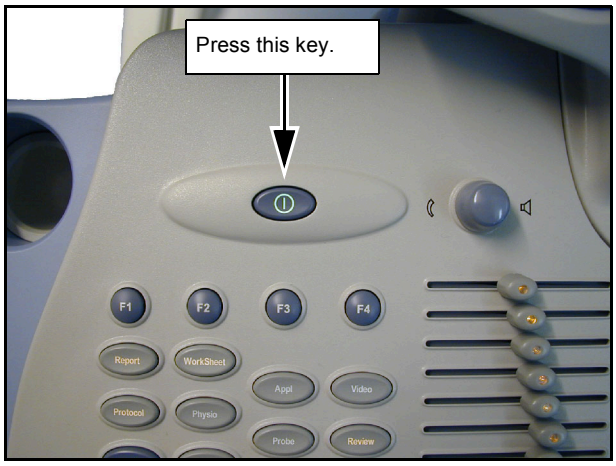


Figure 4-3 Press ON-OFF key once

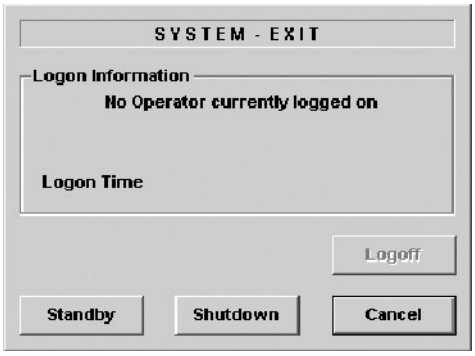


Figure 4-4 System - Exit menu

The System - Exit menu gives you the following choices:

- **Logoff**
  Use this button to log off the current user.
  The system remains on and ready for a new user to log on.
  The dimmed button in Figure 4-2 on page 4-6 indicates that no user is logged on to the unit at the moment.
- **Standby**
  Use this button to select the Standby mode, allowing a shorter reboot time.
- **Shutdown...**
  Use this button to Shut Down the system.The next step describes the use of this button.
- **Cancel**
  Use this button to exit from the System-Exit menu and return to the previous operation.

4-2-2-3 Full Power Shut Down (cont'd)

2.) Click SHUTDOWN to do a complete power down of the unit.

Backend Processor will first turn OFF the Scanner activity and print the message "Please wait - Shutdown in progress" in the LCD display. Then it starts to shut down itself. The time to turn down the Scanner including the Backend Processor, may vary from 10 seconds up to approximately 1 minute. The last thing that shut down, is the light in the LCD displays, indicating that you can continue to the next step.

3.) Switch OFF the **CIRCUIT BREAKER** (located on the rear of the unit)

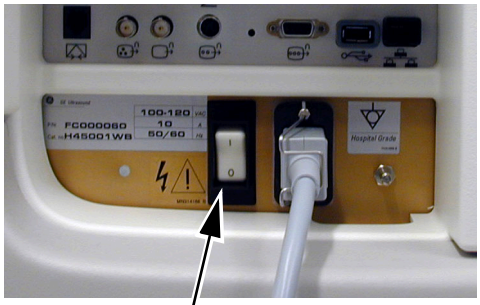


Figure 4-5 Circuit Breaker located on rear of the unit

This will cut power distribution within the unit.

If the Backend Processor is still running, the internal Un-interupted Power Supply (UPS) will switch over to battery power and supply the Backend Processor with power until it has shut down properly. A periodic high-pitch sound alarm indicates that the Backend Processor is running on battery power.

4-2-3 Using Removable Media

4-2-3-1 Introduction

Vivid 7 / Vivid 7 PRO is equipped with a Magneto Optical Disk Drive (MO Drive) and a CD Drive. Both units are available from the front of the unit, below the Patient I/O panel.

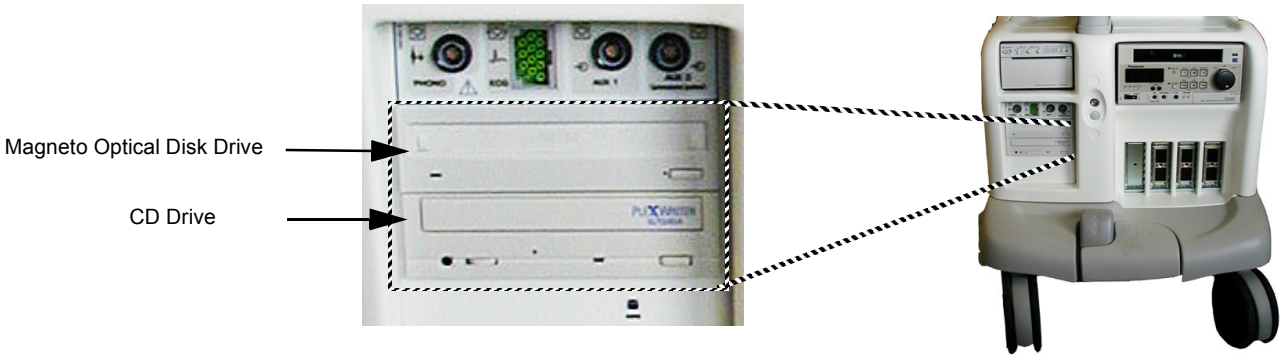


Figure 4-6 MO Drive and CD Drive

4-2-3-2 Install MO Disk in MO Drive

NOTICE **Never move the unit with a MO disk in the Magneto Optical Disk Drive because the drive actuator will not be locked and the Magneto Optical Disk Drive could break.**

1.) Preparations before installing an MO disk in the MO Drive:

a.) The unit must be turned on and "up and running" before using the MO Drive

b.) Verify the MO disk for loose hardware or damaged labels which could jam inside the MO Drive.

c.) Ensure that the slide switch in one corner of the disk is set so that the disk is write enabled (disk hole closed).

2.) Insert the disk into the MO Disk Drive with the label for the side you intend to use, facing up.

4-2-3-3 Eject and Remove MO Disk from MO Drive

NOTICE Do not eject the MO Disk using the button on front of the MO drive.

1.) Eject the MO Disk, using one of the methods described in the following steps:

a.) In some cases, the MO Disk is ejected automaticly.

b.) If not automaticly ejected, use manual ejection method:

- Select Eject button on the screen, or
- Press **ALT** + **E** on the alphanumeric keyboard to display the Eject Device menu.



Figure 4-7 The Eject Device menu

2.) Select 5 1/4 MO DISK in the Eject Device menu to eject the MO Disk.

3.) Remove the ejected MO Disk from the MO Drive and store it in it's cover box in a safe place.

4-2-3-4 Install CD-R Disk in CD Drive

NOTE: CD-RW disks are NOT supported by Vivid 7 / Vivid 7 PRO, but CD-R disks may be used.

1.) Press the Eject button on the right side of the CD Drive once to open the disk tray.

2.) Put a CD-R disk in the disk tray with the label side facing up.

3.) Press the Eject button once to close the disk tray. The disk is available for reading, formatting or writing, dependant on the disk you used, after a few seconds.

4-2-3-5 Eject and Remove CD-R Disk from CD Drive

⚠ **NOTICE** Do not eject the CD-R Disk using the button on front of the CD Drive.

1.) Eject the CD-R Disk, using one of the methods described in the following steps:

a.) In some cases, the CD-R Disk is ejected automaticly.

b.) If not automaticly ejected, use manual ejection method:

- Select Eject button on the screen, or
- Press **ALT** + **E** on the alphanumeric keyboard to display the Eject Device menu.



Figure 4-8 The Eject Device menu

2.) Select CD-REWRITEABLE in the Eject Device menu to eject the CD-R Disk.

3.) Remove the ejected CD-R Disk from the CD Drive and store it in it's cover in a safe place.

4-2-4 Labeling Removable Media

Before you start to format any Removable Media, be sure about what naming convention you will use for labelling.

- Use a logical name and make sure to physically label each Removable Media.
- Verify that each Removable Media gets a unique name. Maximum eleven (11) characters may be used for the label name.
- Remember that MO Disks have two sides, Side A and Side B. Each Side must have a unique name.

Example: MO Disks for storing images may be labeled "IMAGE_1A" (Side A on MO Disk #1), "IMAGE_1B (Side B on MO Disk #2), "IMAGE_2A" ...

4-2-5 Formatting Removable Media

This procedure describes how to format an MO Disk or a CD-R disk.

Before you continue, be sure about what naming convention you will use for labelling the Removable Media.

1.) Select Config > Connectivity > Media
2.) Select the removable media from the *Media pop-up menu*.
3.) Enter a name for the removable media in the *Label field*.
4.) Press FORMAT.
5.) Wait for the display of the *Information window* indicating that the formatting process is completed.

NOTE: Do not eject the CD using the button on the CD drive

6.) Press ALT+E to display the Eject Device menu.
7.) Select the relevant media. The selected media is ejected.

4-2-6 Verifying Removable Media

1.) Insert the removable media to verify.
2.) Select the pre-configured removable media from the Config > Connectivity > Media pop-up menu.
3.) Press VERIFY. The unit starts to verify the DICOM directory on the selected media.

4-2-7 Archiving and Loading Presets

NOTE: Always save presets before any software reload. This action is necessary to ensure that the presets loaded after the software reload are as up–to–date as possible.

All user presets except changes to Summary, Anatomy, and Biometry pages, can be saved on an MO disk for reloading on the system.

⚠ **NOTICE** Presets shouldn't be saved on the same MO disk as images, because the Archive Menu lists the images but not the presets stored on a MO disk.

4-2-7-1 Archiving Presets to an MO Disk

Table 4-4 Saving Presets

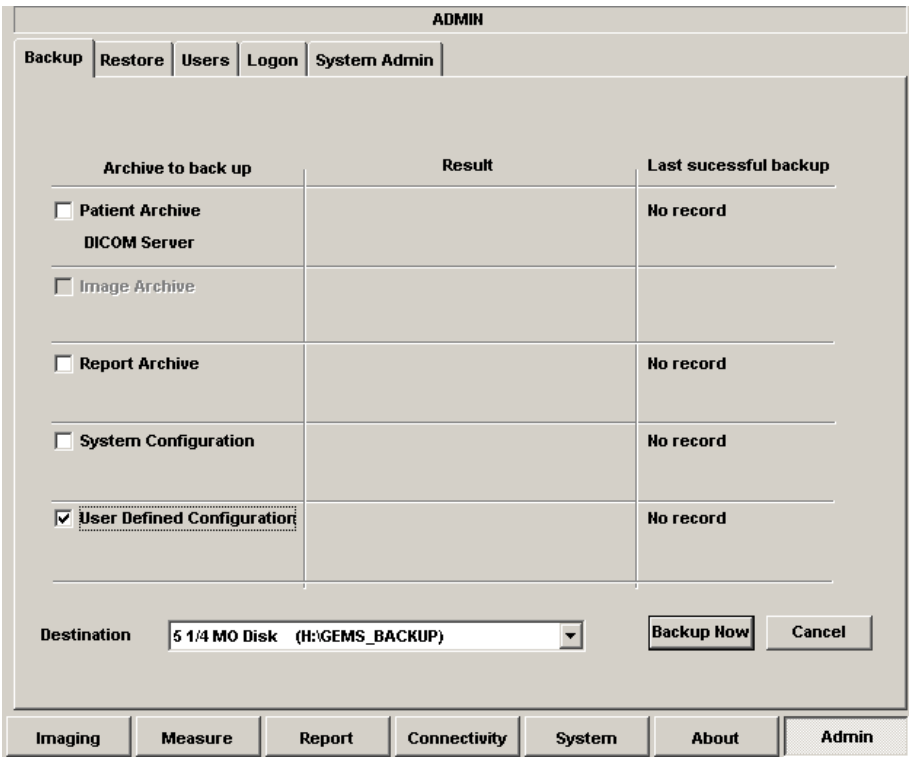
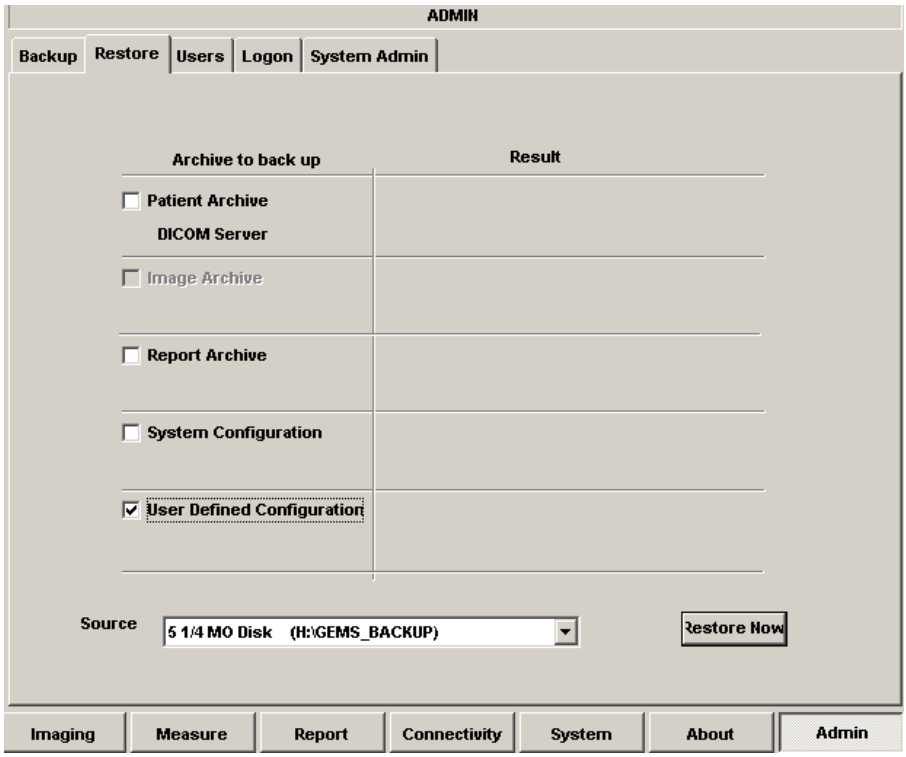
STEP	TASK	FUNCTION
1.	Insert an empty, formatted MO disk labelled "PRESETS" and marked with Vivid 7 / Vivid 7 PRO's serial number and the date, into the MO Drive (for formatting, see chapter 12 in the Vivid 7 User's Manual).	
2.	Go to Config (F2) -> Admin -> Backup	The Backup window is displayed. 
3.	Select the Check box "User defined Configuration".	
4.	Select the MOD as destination.	
5.	Press **BACKUP NOW**.	A copy of the Presets is saved on the MO disk.

Table 4-4 Saving Presets (continued)

STEP	TASK	FUNCTION
6.	Press **ALT** + **E** on the alphanumeric keyboard.	The MO disk is ejected.

4-2-7-2 Loading Presets from an MO Disk

Table 4-5 Loading Presets

STEP	TASK	FUNCTION
1.	Insert the MO disk with the archived presets into the MOD.	
2.	Go to Config (F2) -> Admin -> Restore	The Restore window is displayed. 
3.	Select the Check box “User defined Configuration”.	
4.	Select the MOD as source.	
5.	Press **RESTORE NOW**	The Presets are restored to the System.
6.	Press **ALT** + **E** on the alphanumeric keyboard.	The MO disk is ejected.

Section 4-3
Functional Checks

4-3-1 Preparation

Turn on power to Vivid 7 / Vivid 7 PRO, see 4-2-1 - Power ON/ Boot Up on page 4-2.

4-3-2 Basic Controls

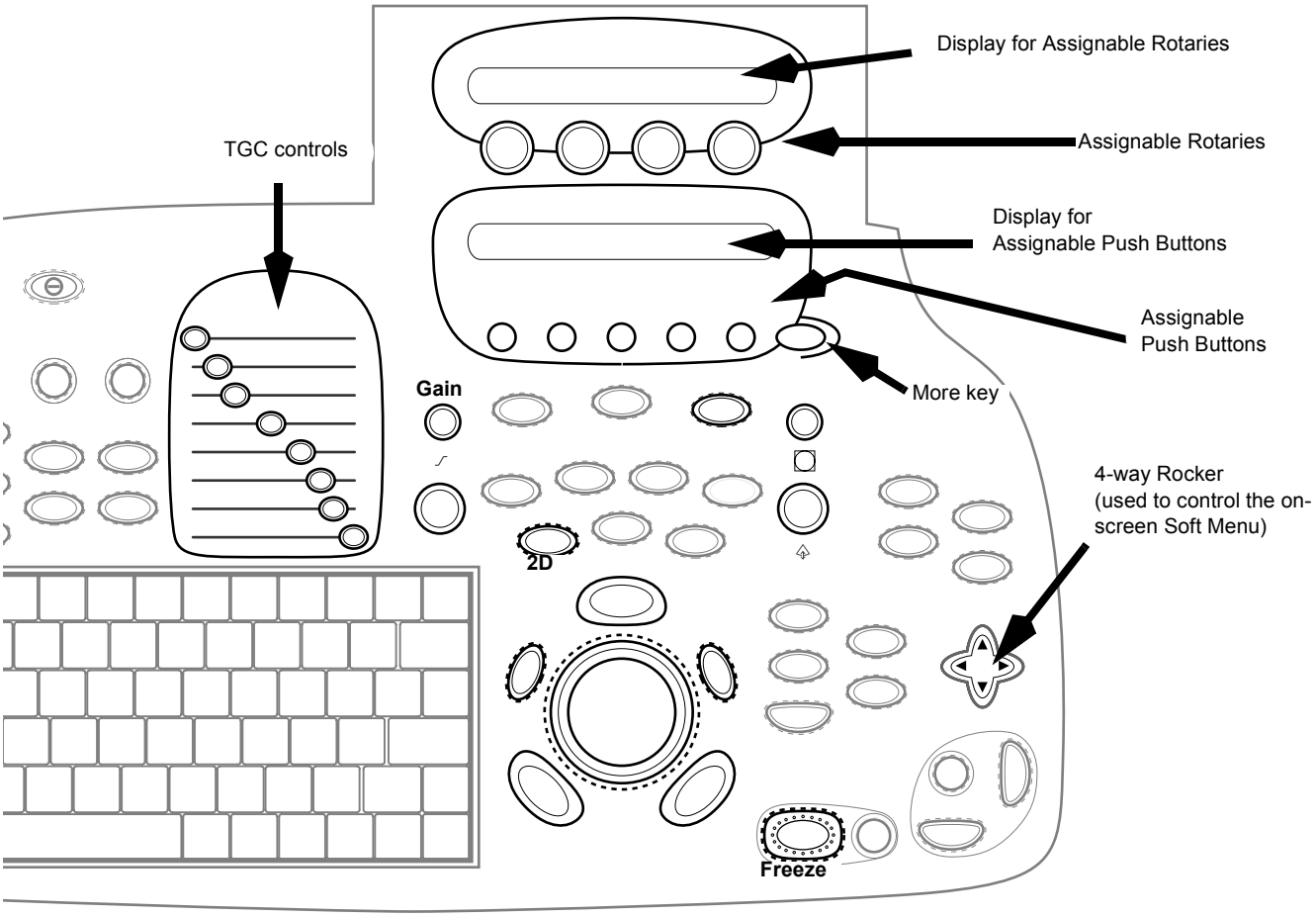


Figure 4-9 2D Mode, 2D Freeze and Cine Replay Controls

4-3-2-1 Introduction

Most of the mode dependant controls can be found as Mode Dependant Keys (Assignable Rotary Knobs and Assignable Push Buttons) and Trackball. The functions available on the Mode Dependant Keys and Trackball vary according to the scan mode and position that is currently active.

4-3-2-2 Assignable Rotary Knobs

Vivid 7 / Vivid 7 PRO has four assignable rotary knobs. The assigned functions are indicated above the rotary on the LCD display.

4-3-2-3 Assignable Push Buttons

Vivid 7 / Vivid 7 PRO has five Assignable Push Buttons. The assigned functions are indicated above the button on the LCD display.

4-3-2-4 More

The **MORE** button gives access to additional controls on the Assignable Push Buttons.

4-3-2-5 Soft Menu Control (4-way Rocker)

The 4-way Rocker works together with the Soft menu on the screen.

- The vertical arrows (up/down) are used to do selections from the Soft Menu.
- The horizontal arrows (left/right) are used to do adjustments on the selected function.

4-3-2-6 Trackball area

Different functions can be assigned to the trackball depending of the current active mode. The Trackball area consist of:

- The Trackball: used as a cursor control in acquisition mode, scrolling control in freeze and as a selection tool (like a mouse cursor) in post-processing mode.
- Three **SELECT** keys (identical): Perform the selected control or highlighted menu item.
- The **TRACKBALL** key: Toggles between the available trackball function assignments displayed in the Status bar.
- The update menu key: enables quick access to image related functions from a pop-up menu.

4-3-2-7 Other Controls

Other controls are located on separate keys (knobs and buttons) or groups of keys on the Control Panel.

4-3-3 Performance Tests

4-3-3-1 Recommended Test Phantoms

GE Medical Systems recommends the RMI 430GS phantom. It is the most current phantom recommended to our field service personnel and provides the necessary targets and extended life necessary for consistent system testing.

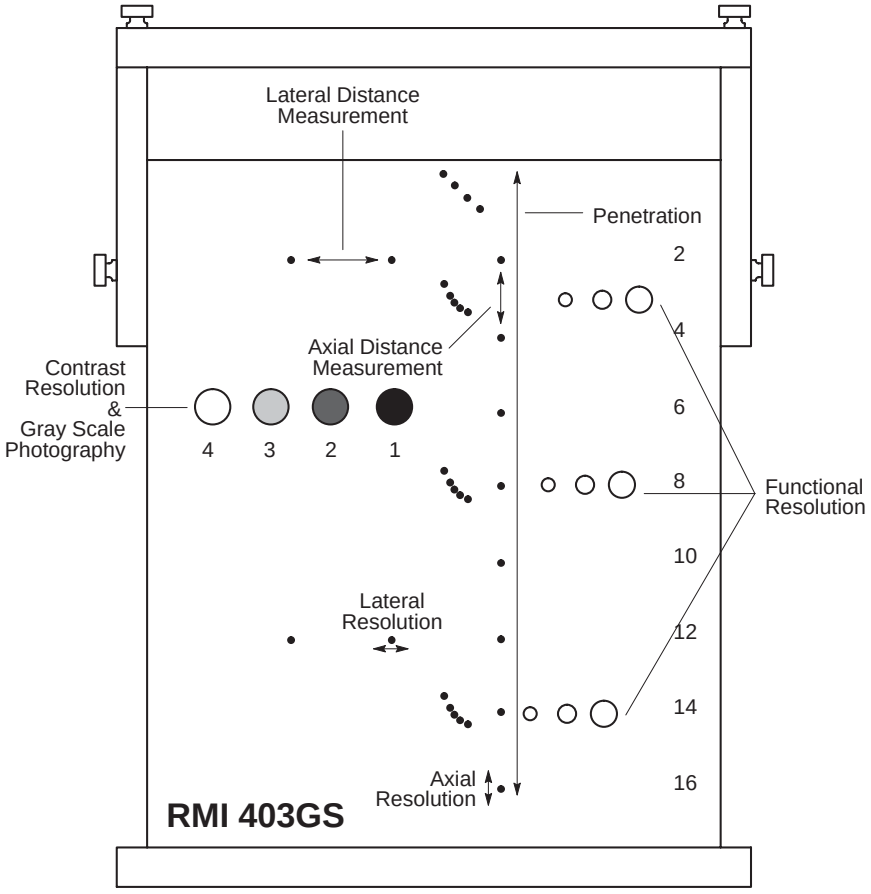


Figure 4-10 Performance tests

4-3-4 2D Mode (B mode) Checks

4-3-4-1 Introduction

The 2D Mode is the system's default mode.

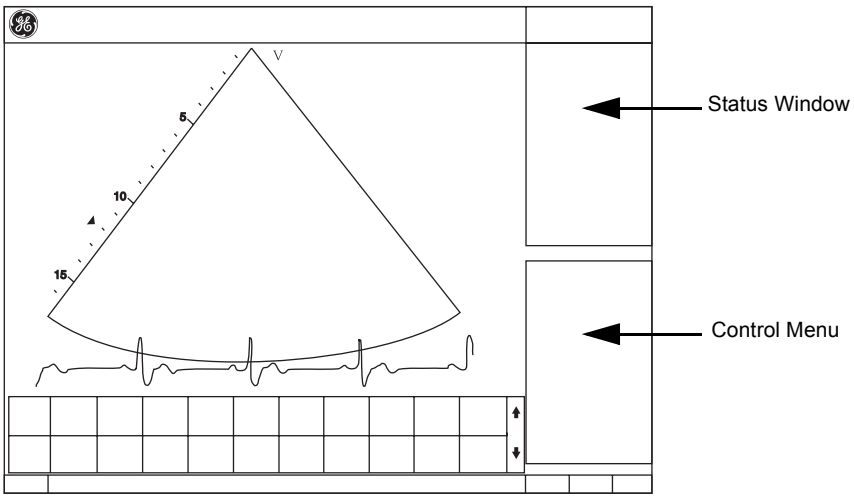


Figure 4-11 2D Mode Screen Example

4-3-4-2 Preparations

Use a phantom when doing these tests.

1.) Connect one of the probes, to the scanner's left-most active probe connector.
   - See "Probe Connection" on page 3-13 for info about connecting the probes.
   - See Chapter 9 - , section 9-17 for available probes.

2.) Turn ON the scanner.
   - See 4-2-1 - Power ON/ Boot Up on page 4-2 for info about booting the scanner.

   The 2D Mode window is displayed (default mode).

3.) If needed, adjust the Display's Brightness and Contrast setting (See "Monitor Adjustments" on page 6-2.).

4-3-4-2 Preparations (cont'd)

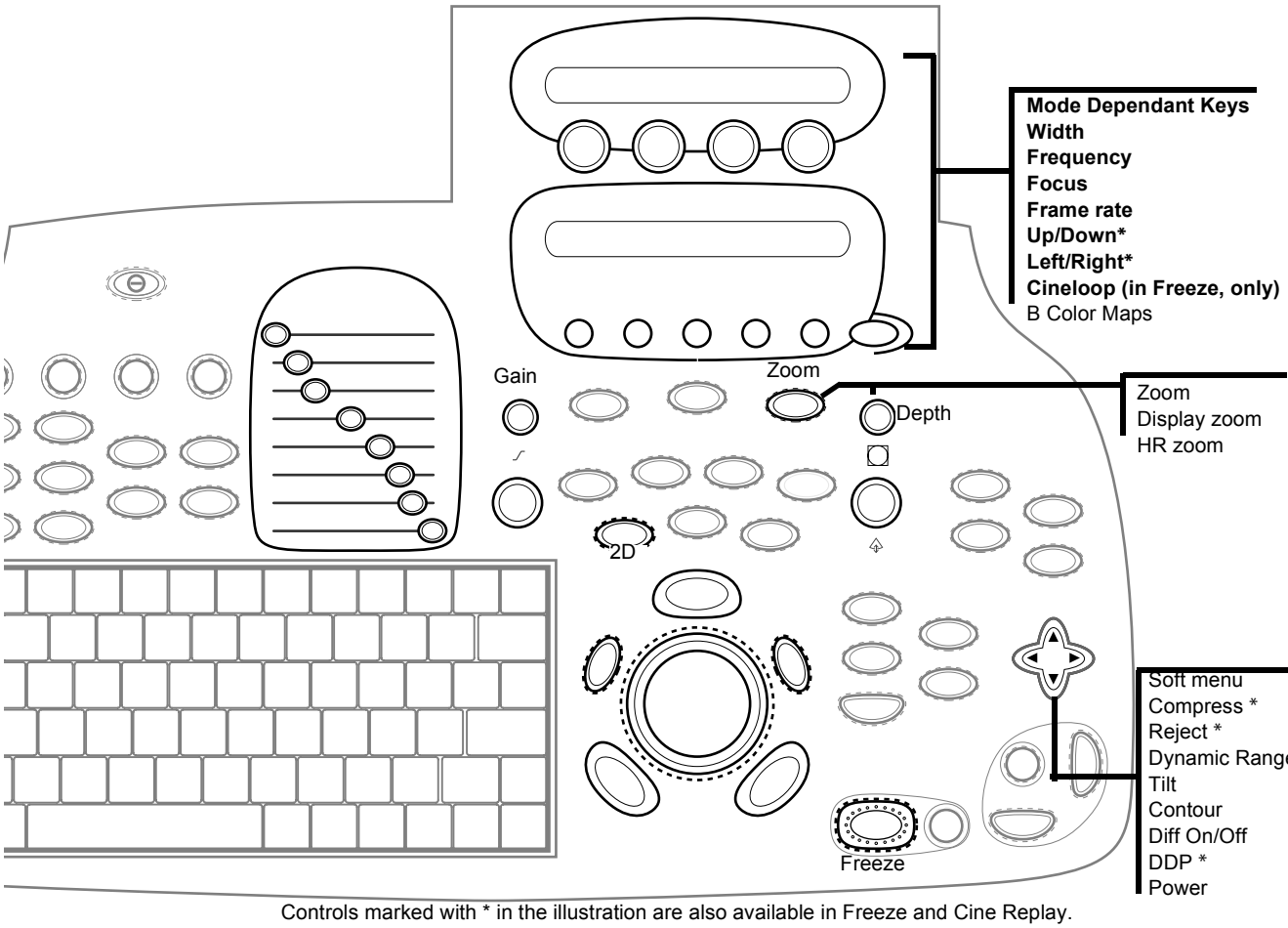


Figure 4-12 Mode Dependent Keys, Zoom and Soft Menu Key

⚠ **WARNING** ***Always use the minimum power required to obtain acceptable images in accordance with applicable guidelines and policies.***

4.) Press **2D** on the Control Panel to access 2D Mode.

5.) These Image Controls are used to optimize the 2D picture:

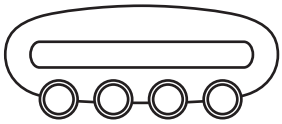
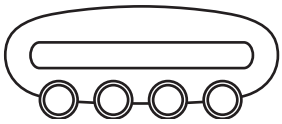
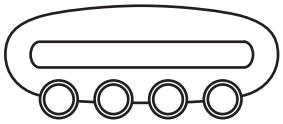
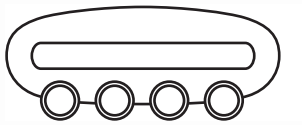
- Use **Gain** and **TGC** controls to optimize the overall image together with the **Power** control.
- Use **Depth** to adjust the range to be imaged.
- Use **Focus** to center the focal point(s) around the region of interest.
- Use **Frequency** (move to higher frequencies) or **Frame rate** (move to lower frame rate) to increase resolution in image.
- Use **Frequency** (move to lower frequency) to increase penetration.
- Use the **DDP** control to optimize imaging in the blood flow regions and make a cleaner, less noisy image.
- Use **Reject** controls to reduce noise in the image.

4-3-4-3 Check Width, Focus, Framerate, Frequency

These 2D Mode Functions are located on Assignable Rotaries.

The results of these adjustments must be verified on the 2D sector on the screen.

Table 4-6 2D Mode: Check Width, Focus, Framerate and Frequency

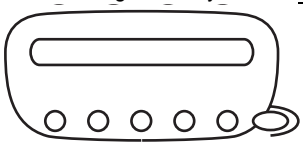
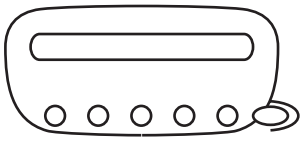
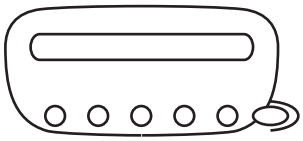
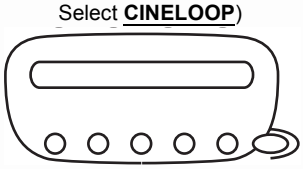
Step	Task	Expected Result
1.	Turn the rotary labeled **WIDTH** left and right. 	Controls the size or angular width of the 2D image sector. A smaller angle generally produces a scan with higher frame rate.
2.	Turn the rotary labeled **FOCUS** left and right to move the focal point up and down. 	Changes the location of the focal point(s). A triangular focus marker indicates the depth of the focal point.
3.	Turn the rotary labeled **FRAMERATE** left and right to adjust the Frame Rate 	Adjusts frame rate. Rotate the knob clockwise to increase frame rate. The relative setting of the frame rate is displayed in the status window. When adjusting frame rate, there is a trade off between spatial and temporal resolution.
4.	Turn the rotary labeled **FREQUENCY** left and right to verify that the probe's operating frequency can be adjusted 	Enables the adjustment of the probe's operating frequency. Rotate the knob clockwise to increase the frequency. The selected frequency is displayed in the status window. For some probes/applications, the lowest frequency settings will be Octave Imaging settings.

4-3-4-4 Check Up/Down, Left/Right, B Color Maps and Cineloop

These 2D Mode Functions are located on Mode Dependant Keys (Push Buttons)

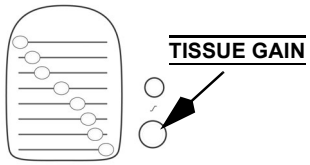
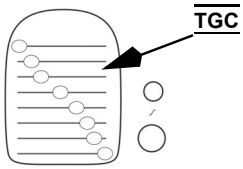
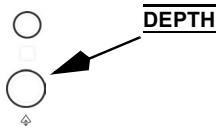
The results of these adjustments must be verified on the 2D sector on the screen.

Table 4-7 2D Mode: Check Up/Down, Left/Right, B Color Maps and Cineloop

Step	Task	Expected Result
1.	Press once on the assignable key labeled **UP/DOWN** 	Enables the 2D image to be flipped 180 degrees.
2.	Press once on the assignable key labeled **LEFT/RIGHT** 	Enables a mirror image of the 2D image to be created. The left/right reference marker **V** moves to the other side of the image.
3.	Select **B COLOR MAPS** 	Displays a 2D Map Menu on the screen to optimize the greyscale presentation. The menu enables an option from a list of non-linear gray-curves or different 2D-colorized curves to be selected.
4.	Press **FREEZE** Select **CINELOOP**) 	Starts cine loop acquisition.

4-3-4-5 Check Gain, TGC and Depth

Table 4-8 2D Mode: Check Gain, TGC and Depth in 2D Mode

Step	Task	Expected Result
1.	Adjust **TISSUE GAIN** 	Increases the overall gain equally for all depth when rotated clockwise
2.	Adjust Time Gain Compensation (TGC) 	Compensates for depth-related attenuation in an image. The upper sliders affect the near field. The lower sliders (nearest the operator) affect the far field.
3.	Adjust Depth 	Sets the maximum (far field) distance that will be imaged. Decreasing the depth may allow higher frame rates

4-3-4-6 2D Soft Menu Controls

Table 4-9 4-way rocker used for Soft Menu control

KEY	DESCRIPTION
	A 4-way rocker (4-way multi direction switch) used to; - access mode-specific menus on the screen. - select a menu option. - adjust option-related values. When using the Rocker; - the vertical arrows are used to select the menu options. - the horizontal arrows are used to adjust the values.

4-3-4-7 Check Compress, Contour, Reject and Tilt

Table 4-10 2D Mode: Check Compress, Contour, Reject and Tilt

Step	Task	Expected Result(s)
1.	Use the vertical arrows to select Compress. Use the horizontal arrows to adjust Compress.	Compress controls the amount of contrast in the 2D image. An index number is displayed in the status window to indicate the relative level of compression.
2.	Use the vertical arrows to select Contour. Use the horizontal arrows to adjust Contour.	Contour controls image processing related to the extent of edge enhancement applied to an image.
3.	Use the vertical arrows to select Reject. Use the horizontal arrows to adjust Reject.	When Reject is increased, low-level echoes and noise are rejected and appear darker in the 2D image. An index number is displayed in the status window to indicate the relative level of rejection.
4.	Use the vertical arrows to select Tilt. Use the horizontal arrows to adjust Tilt.	Tilts the axis of the 2D image to the left or right. By using this control in combination with Angle control, the image can be “aligned” to the direction of interest, and frame rates be optimized. By default the axis of symmetry of a 2D image is vertical.

4-3-4-8 Check DDP, Diff, Power and Dynamic Range

Table 4-11 2D Mode: Check DDP, Diff, Power and Dynamic Range

Step	Task	Expected Result(s)
1.	Use the vertical arrows to select DDP (Data Dependent Processing). Use the horizontal arrows to adjust DDP.	Performs temporal processing which reduces random noise without affecting the motion of significant tissue structures. An index number is displayed in the status window (under Proc) to indicate the relative DDP level.
2.	Use the vertical arrows to select Diff. Use the horizontal arrows to turn Diff On/Off.	Affects the level of reverberations in the image. When turned ON, the frame rate (or the number of focal zones) will decrease, while the reverberations will be attenuated.
3.	Use the vertical arrows to select Power. Use the horizontal arrows to adjust Power.	Controls the amount of acoustic power applied in all modes. When power is set to maximum, it is equal to or less than the maximum acoustic power permitted by the FDA. The Thermal Index (TI) and the Mechanical Index (MI) are displayed on the screen.
4.	Use the vertical arrows to select Dynamic Range. Use the horizontal arrows to adjust Dynamic Range.	Enables control of the dynamic range or contrast of the image. When Dynamic Range is set high, the image is softer and more low-level data is visible.

4-3-5 M Mode Checks

4-3-5-1 Introduction

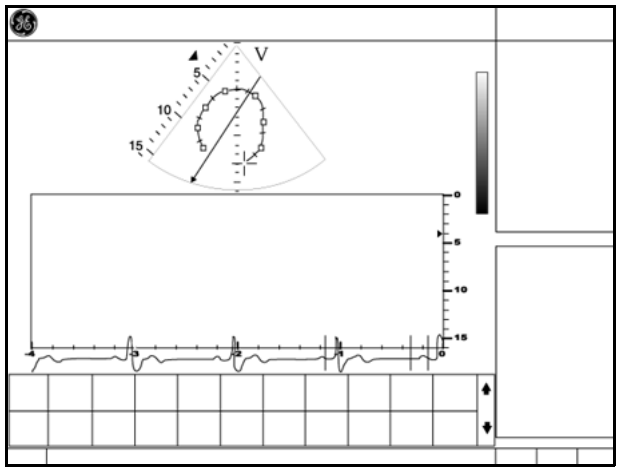


Figure 4-13 M-Mode Screen Example

4-3-5-2 Preparations

Use a phantom when doing these tests.

1.) Connect one of the probes, to the scanner's left-most probe connector.
- See "Probe Connection" on page 3-13 for info about connecting the probes.
- See Chapter 9 - , section *9-17* for available probes.

2.) Turn ON the scanner.
- See see 4-2-1 - Power ON/ Boot Up on page 4-2 for info about booting the scanner.

The 2D Mode window is displayed (default mode).

3.) Press **M-MODE** to bring up an M-Mode picture on the screen.

4-3-5-2 Preparations (cont'd)

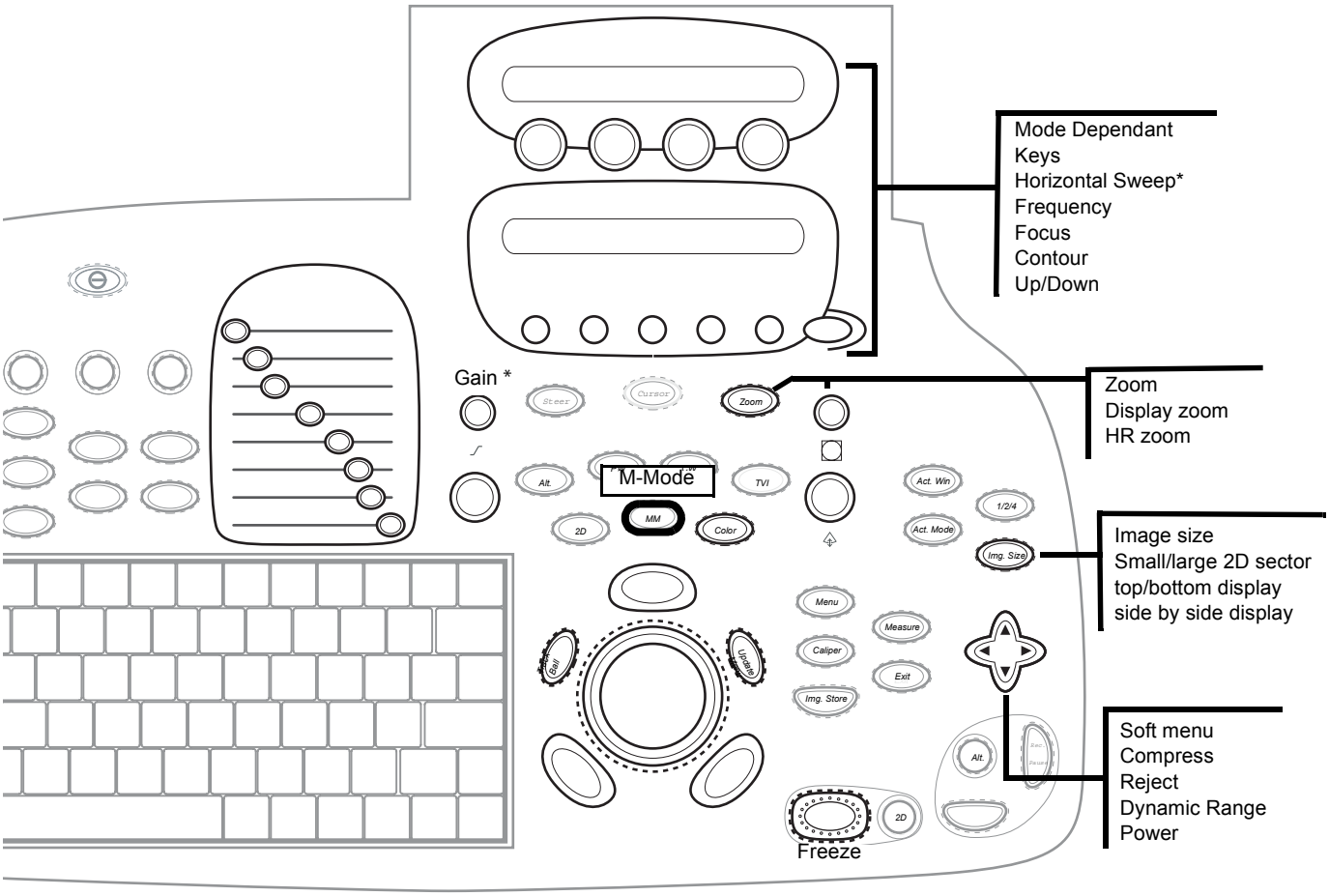
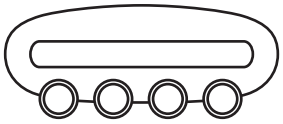
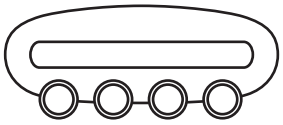
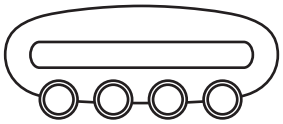
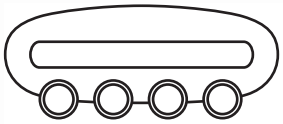


Figure 4-14 M Mode, Freeze and Cine Replay controls

4-3-5-3 Check Horizontal Sweep, Frequency, Focus and Contour

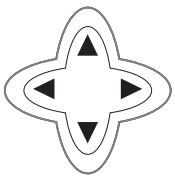
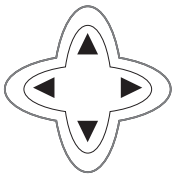
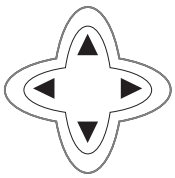
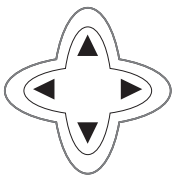
Table 4-12 M-Mode: Check Horizontal Sweep, Frequency, Focus and Contour

Step	Task	Expected Result(s)
1.	Adjust **HORIZONTAL SWEEP** 	Adjusts the horizontal refresh rate of the M-Mode area of the display. Horizontal sweep does not change the acquisition resolution, so you can change the horizontal sweep in replay without any loss of quality.
2.	Adjust **FREQUENCY** Rotate the knob clockwise to increase the probe's operating frequency. 	The probe's operating frequency is increased. The selected frequency is displayed in the status window. For some probes/applications the lowest frequency settings will be Octave imaging settings.
3.	Adjust **FOCUS** 	Changes the location of the focal point(s). A triangular focus marker indicates the depth of the focal point.
4.	Adjust **CONTOUR** 	Controls image processing related to the extent of edge enhancement applied to an image.

4-3-5-4 Check Compress, Reject, Power and Dynamic Range

. .

Table 4-13 M-Mode Soft menu Controls check

Step	Task	Expected Result(s)
1.	Adjust Compress 	Controls the amount of contrast in the image. An index number is displayed in the status window to indicate the relative level of compression.
2.	Adjust Reject 	Adjust reject level. When Reject is increased, low-level echoes are rejected and appear darker in the image. An index number in the status window indicates the relative level of rejection.
3.	Adjust Power 	Controls acoustic power in all modes. When power is set to maximum, it is equal to or less than the maximum acoustic power permitted by the FDA. Both Thermal Index (TI) and Mechanical Index (MI) are displayed on the screen.
4.	Adjust Dynamic Range 	Enables control of the dynamic range or contrast of the image. When dynamic range is set to High, the image is softer and more low-level data is visible.

4-3-6 Color Mode Checks

4-3-6-1 Introduction

Color Flow screens is 2D or M Mode screens with colors representing blood or tissue movement.

Color Flow may be selected both from 2D mode or from M mode or a combination of these.

4-3-6-2 Preparations

Use a phantom when doing these tests.

1.) Connect one of the probes, to the scanner's left-most probe connector.
- See *"Probe Connection" on page 3-13* for info about connecting the probes.
- See *Chapter 9 -* , section *9-17* for available probes.

2.) Turn ON the scanner.
- See 4-2-1 - Power ON/ Boot Up on page 4-2 for info about booting the scanner

The 2D Mode window is displayed (default mode).

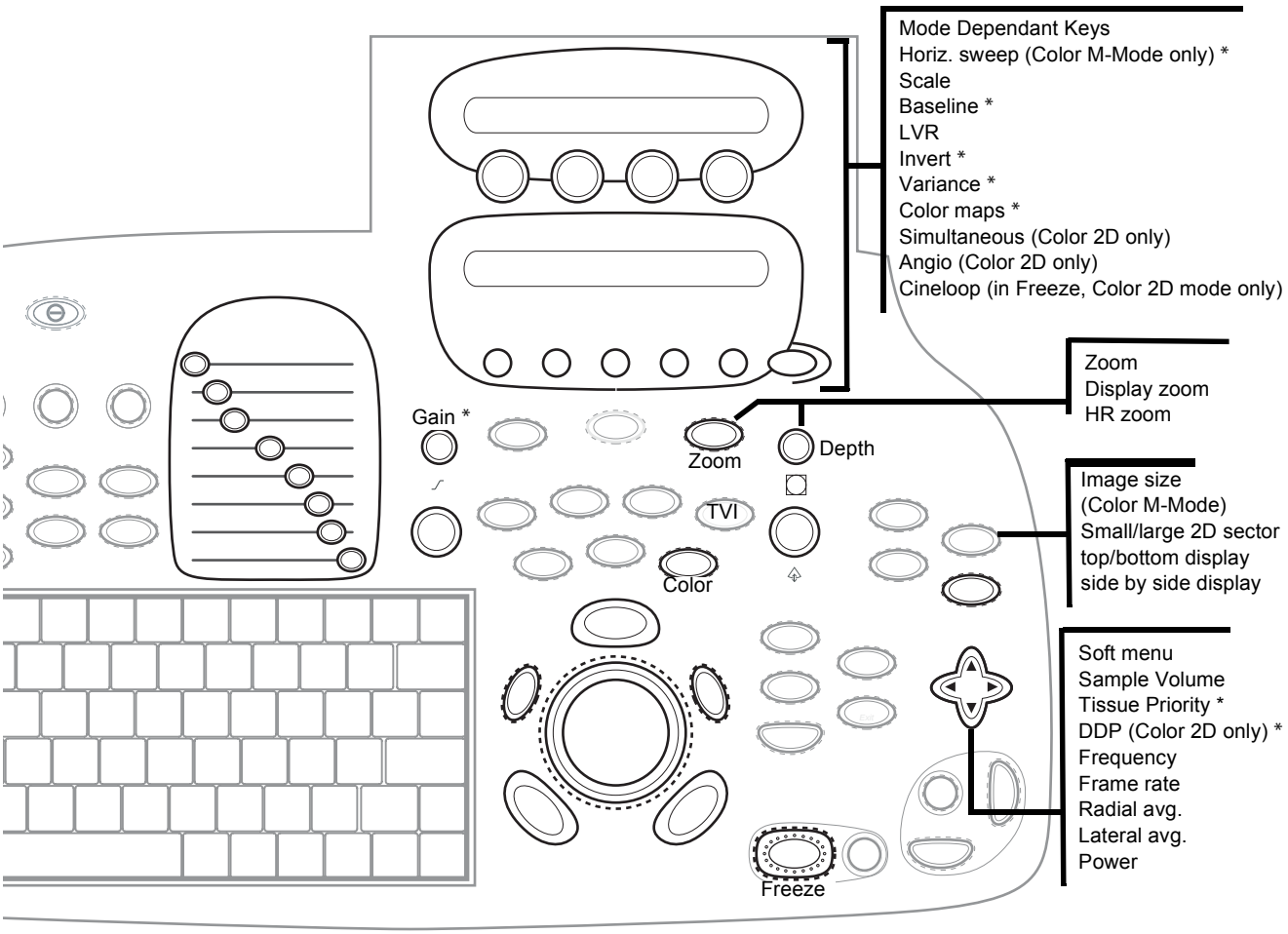
4-3-6-3 Color 2D Mode:

Press **COLOR**.

4-3-6-4 Color M Mode:

1.) Press **MM** (M Mode) to bring up an M Mode display on the screen.
2.) Press **COLOR**.

4-3-6-2 Preparations (cont'd)

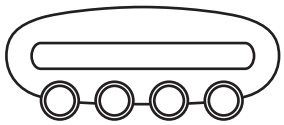
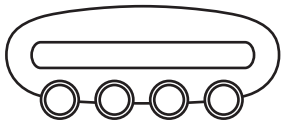
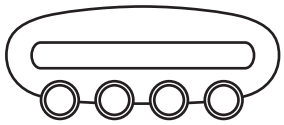
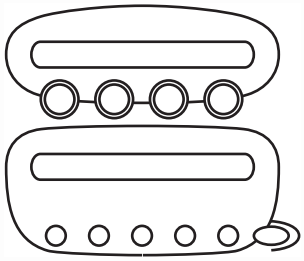
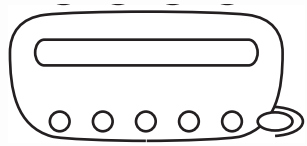


Controls marked with * are also available in freeze and cine replay

Figure 4-15 Color Flow Mode Controls

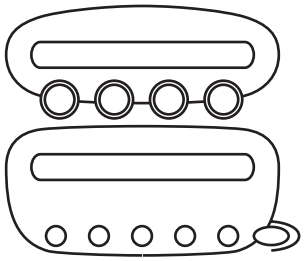
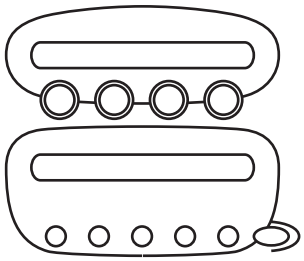
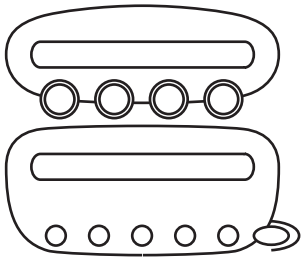
4-3-6-5 Check Horizontal Sweep, PRF, Baseline, LVR and Invert

Table 4-14 Color Flow Mode Controls Check

Step	Task	Expected Result(s)
1.	Adjust Horizontal Sweep (Color M-Mode only) 	Adjusts the horizontal refresh rate of the M-Mode area of the display.
2.	Adjust Baseline 	Adjusts the color map to emphasize flow either toward or away from the probe. Baseline is available in both Live and Freeze.
3.	Change PRF (Pulse Repetition Frequency) 	Adjusts the repetition rate of the Doppler pulses transmitted to acquire the data for color flow mapping. The PRF (Nyquist limit) should be adjusted so that no aliasing occur, while still having a good resolution of velocities, meaning the Nyquist limit should be somewhat above the maximum velocity found in the data.
4.	Adjust LVR (Low Velocity Rejection 	LVR, also called Wall Motion Filter, enables the extent of low velocity removal to be adjusted.
5.	Invert 	Enables the color scheme assigned to positive and negative velocities to be inverted. Invert is available in live and Cine Replay.

4-3-6-6 Check Variance, Color Maps and Cineloop

Table 4-15 Color Flow Mode: Check Variance, Color Maps and Cineloop

Step	Task	Expected Result(s)
6.	Adjust Variance 	Controls the amount of variance data added to a color display. Variance enables computer-aided detection of non-luminary flow (e.g. jets or regurgitation). Variance is available in live and cine replay.
7.	Select Color Maps 	Displays a menu of color map options. Use the trackball to point to a color map and press **SELECT** to activate the desired color map. Each color map is assigning different color hues to different velocities.
8.	Make Cineloop (in Freeze, Color 2D mode only) 	Starts cine loop acquisition.

4-3-6-7 Check Sample Volume and Tissue Priority

Table 4-16 Color Flow Mode: Check Variance, Color Maps and Cineloop

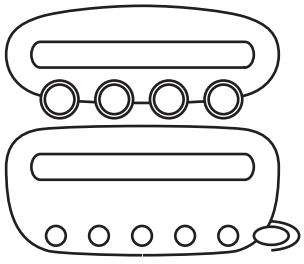
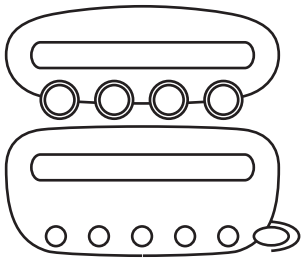
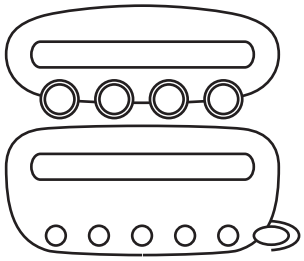
Step	Task	Expected Result(s)
9.	Adjust Variance 	Controls the amount of variance data added to a color display. Variance enables computer-aided detection of non-luminary flow (e.g. jets or regurgitation). Variance is available in live and cine replay.

Table 4-16 Color Flow Mode: Check Variance, Color Maps and Cineloop

Step	Task	Expected Result(s)
10.	Select Color Maps 	Displays a menu of color map options. Use the trackball to point to a color map and press **SELECT** to activate the desired color map. Each color map is assigning different color hues to different velocities.
11.	Make Cineloop (in Freeze, Color 2D mode only) 	Starts cine loop acquisition.

4-3-6-8 Check Frequency, Radial Averaging, Lateral Averaging, Power

Table 4-17 Color-Mode Soft Menu Controls Check

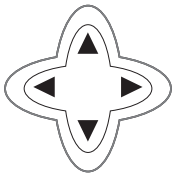
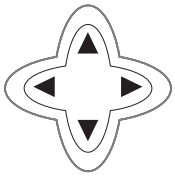
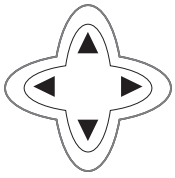
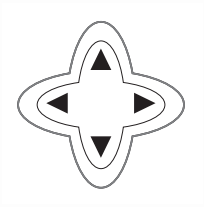
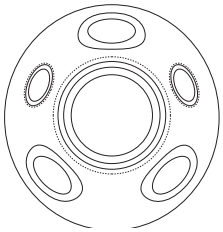
Step	Task	Expected Result(s)
1.	Adjust Frequency 	Enables the adjustment of the transmission frequency to control the sensitivity or the level of penetration. The selected frequency is displayed in the status window. Adjusting Frequency may affect Sample Volume and LVR settings.
2.	Adjust Radial Averaging 	Smooths the image by averaging collected data along the same radial line. An increase of the radial averaging will reduce noise, but this will also reduce the radial resolution.
3.	Adjust Lateral Averaging (Color 2D only) 	Smooths the image by averaging collected data along the same horizontal line. An increase of the lateral averaging will reduce noise, but this will also reduce the lateral resolution.

Table 4-17 Color-Mode Soft Menu Controls Check

Step	Task	Expected Result(s)
4.	Adjust Power 	Controls the amount of acoustic power applied in all modes. When power is set to maximum, it is equal to or less than the maximum acoustic power permitted by the FDA. The Thermal Index (TI) and the Mechanical Index (MI) are displayed on the screen.

4-3-6-9 Adjust ROI

Table 4-18 Adjust ROI

Step	Task	Expected Result(s)
1.	Adjust Sample volume 	Adjusts the size of the color flow Doppler sampling area. Lower setting gives better flow resolution while a higher setting increases sensitivity and helps to locate disturbed flows.

4-3-7 Doppler Mode Checks

4-3-7-1 Introduction

Doppler is used to measure velocity (most often in blood).

Doppler mode can be done with a special pencil probe or with an ordinary probe. By using an ordinary probe, you can first bring up a 2D picture for navigation purpose and then add Doppler.

4-3-7-2 Preparations

Use a phantom when doing these tests.

1.) Connect one of the probes, to the scanner's left-most probe connector.
   - See *Probe Connection*, page *3-13* for info about connecting the probes
   - See *Probes*, page *9-28* for available probes

2.) Turn ON the scanner
   - See 4-2-1 - Power ON/ Boot Up on page 4-2 for info about booting the scanner.

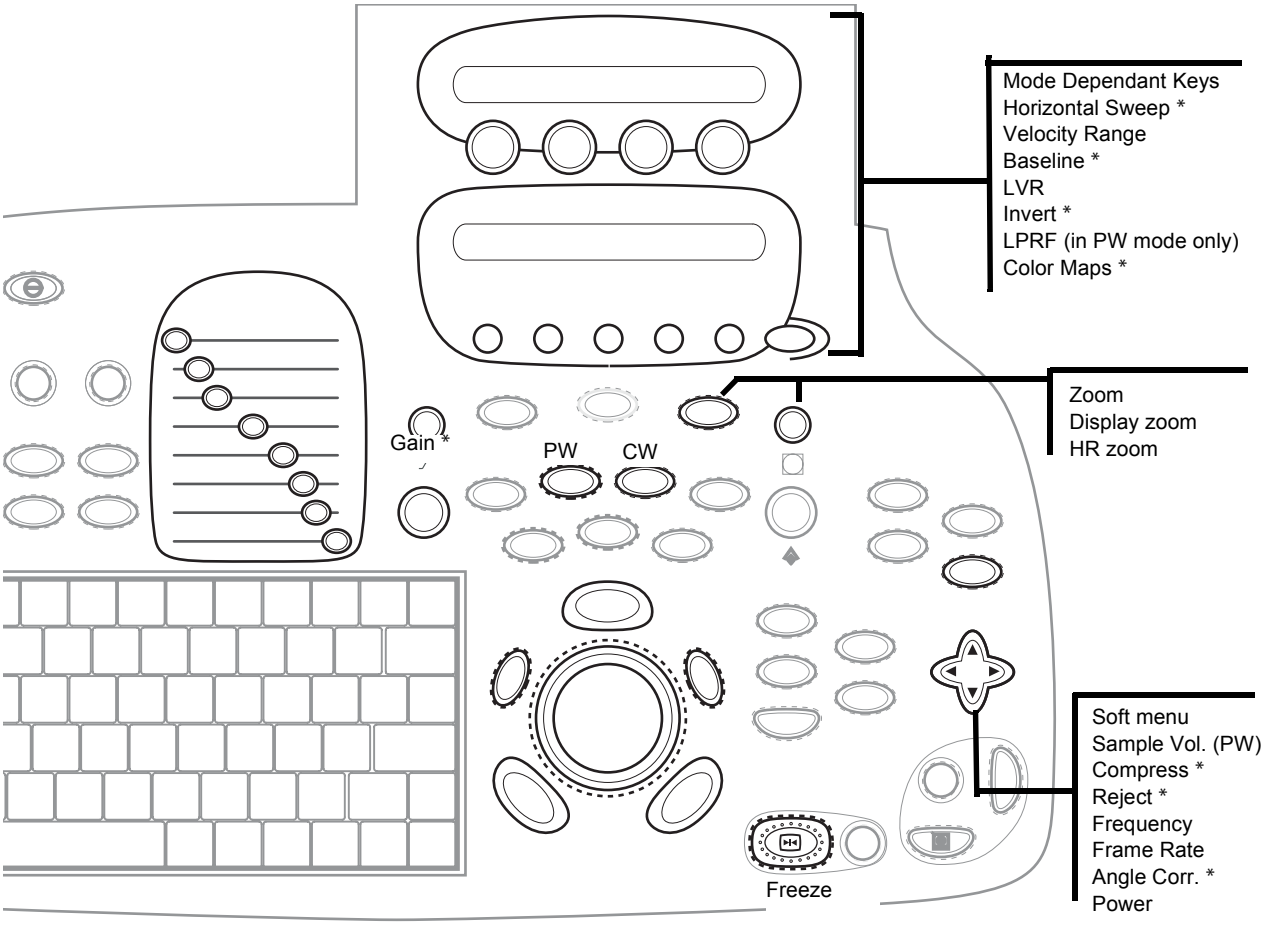
   The 2D Mode window is displayed (default mode).

3.) If needed, adjust the Display's Brightness and Contrast setting.

4.) Press PW or CW to start Pulsed Wave Doppler (PW) or Continuous Wave Doppler (CW).

5.) Use the trackball to select the Area of Interest (Sample Volume) in PW or direction of interest in CW.

4-3-7-2 Preparations (cont'd)

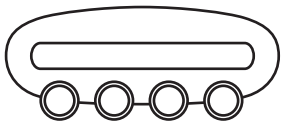
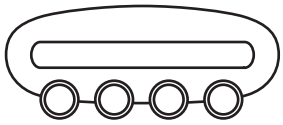
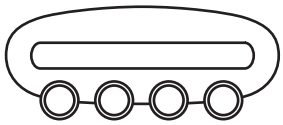
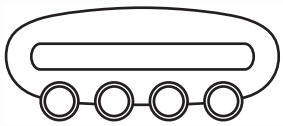


Controls marked with * (asterisk) are also available in freeze and cine replay

Figure 4-16 Doppler Mode Controls

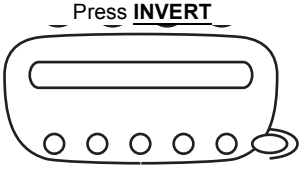
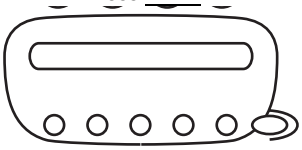
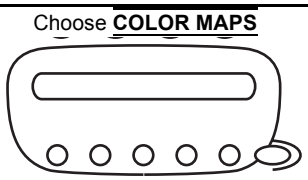
4-3-7-3 Check Horizontal Sweep, Velocity Range, Baseline and Low Velocity Reject

Table 4-19 Doppler Mode Controls Checks

Step	Task	Expected Result(s)
1.	Adjust **HORIZONTAL SWEEP** 	Adjusts the horizontal refresh rate of the Doppler area of the display. Horizontal sweep is available in live and cine replay.
2.	Adjust **VELOCITY RANGE** 	Enables the vertical scale of the Doppler spectrum and the maximal detectable velocity to be modified. Velocity range directly controls the pulse repetition frequency, which is responsible for the setting of the Nyquist limit (the ability to detect maximal velocity without aliasing).
3.	Move **BASELINE** 	Enables the Doppler baseline to be shifted up and down. The default Doppler baseline is set at the center of the vertical aspect of the Doppler display, dividing evenly the flow toward and away from the probe. By adjusting the baseline a larger portion of the analysis is assigned to the flow direction present. Baseline is available in live and cine replay.
4.	Adjust Low Velocity Reject (**LV REJ**.) 	Enables the low velocity portions of the spectrum to be filtered, since the Doppler spectrum and audio may contain strong wall-motion signals. The amount of LV Rej. is indicated by the green vertical bar at the right end of the baseline.

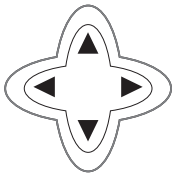
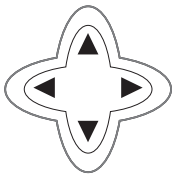
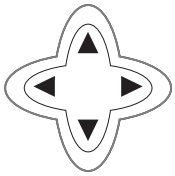
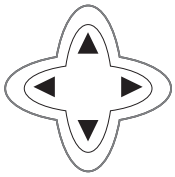
4-3-7-4 Check Invert, LPRF (in PW only) and Color Maps

Table 4-20 Doppler Mode Controls Checks

Step	Task	Expected Result(s)
5.	Press **INVERT** 	Enables the Doppler spectrum to be flipped 180 degrees, so that negative velocities are displayed above the baseline and positive velocities below the baseline. Invert is available in live and cine replay.
6.	Press **LPRF** 	In PW, adjusts the pulse repetition frequency for the PW Doppler acquisition of data flow.
7.	Choose **COLOR MAPS** 	Displays a drop down menu of different Doppler colorization maps. Use the trackball to select the desired map and press Select to activate the map.

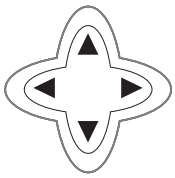
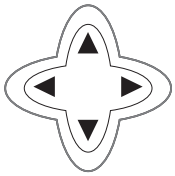
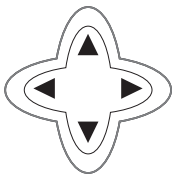
4-3-7-5 Check Sample Volume, Compress, Reject and Frequency

Table 4-21 PW/CW Doppler Mode: Check Sample Volume, Compress, Reject and Frequency

Step	Task	Expected Result(s)
1.	Adjust **SAMPLE VOLUME** (SV) 	In PW mode, set the longitudinal size of the region to be sampled for measurement. Adjusting Sample volume may affect the PRF (Nyquist limit) settings. SV does not apply to CW mode, where the volume sampled is the full length of the area indicated by the cursor line.
2.	Change **COMPRESS** 	Enables control over the contrast of the Doppler spectrum. When compression is raised, the spectrum image becomes softer and some low level background noise may appear. Compress is available in both Live and Freeze.
3.	Adjust **REJECT** 	Enables undesirable background noise to be removed from the Doppler spectrum resulting in a darker background. Reject is available in both Live and Freeze.
4.	Change **FREQUENCY** 	Adjusts the transmission frequency in Doppler to control sensitivity or level of penetration. The selected frequency is displayed in the status window. Adjusting Frequency may affect Sample Volume (PW) and LVR settings.

4-3-7-6 Check Frame Rate, Angle Correction and Power

Table 4-22 PW/CW Doppler Mode: Check Frame Rate, Angle Correction and Power

Step	Task	Expected Result(s)
5.	Adjust **FRAME RATE** 	Adjusts frame rate. The relative setting of the frame rate is displayed in the status window (under 2D).
6.	Adjust **ANGLE CORRECTION** 	Enables correction of the Doppler velocity scale by defining the angle between the Doppler beam and the investigated blood vessel. A thin cross bar on the Doppler cursor will rotate as the control is adjusted. Angle correction is available in both Live and Freeze.
7.	Adjust **POWER** 	Controls the amount of acoustic power applied in all modes. When power is set to maximum, it is equal to or less than the maximum acoustic power permitted by the FDA. The Thermal Index (TI) and the Mechanical Index (MI) are displayed on the screen.

4-3-8 Tissue Velocity Imaging (TVI) Checks

4-3-8-1 Introduction

TVI calculates and color codes the velocities in tissue. The tissue velocity information is acquired by sampling of tissue Doppler velocity values at discrete points.

4-3-8-2 Preparations

Use a phantom when doing these tests.

1.) Connect one of the probes, to the scanner's left-most probe connector.
   - See *Probe Connection*, page *3-13* for info about connecting the probes
   - See *Probes*, page *9-28* for available probes

2.) Turn ON the scanner
   - See see 4-2-1 - Power ON/ Boot Up on page 4-2 for info about booting the scanner.

   The 2D Mode window is displayed (default mode).

3.) If needed, adjust the Display's Brightness and Contrast setting.

4.) Press **TVI**.

4-3-8-2 Preparations (cont'd)

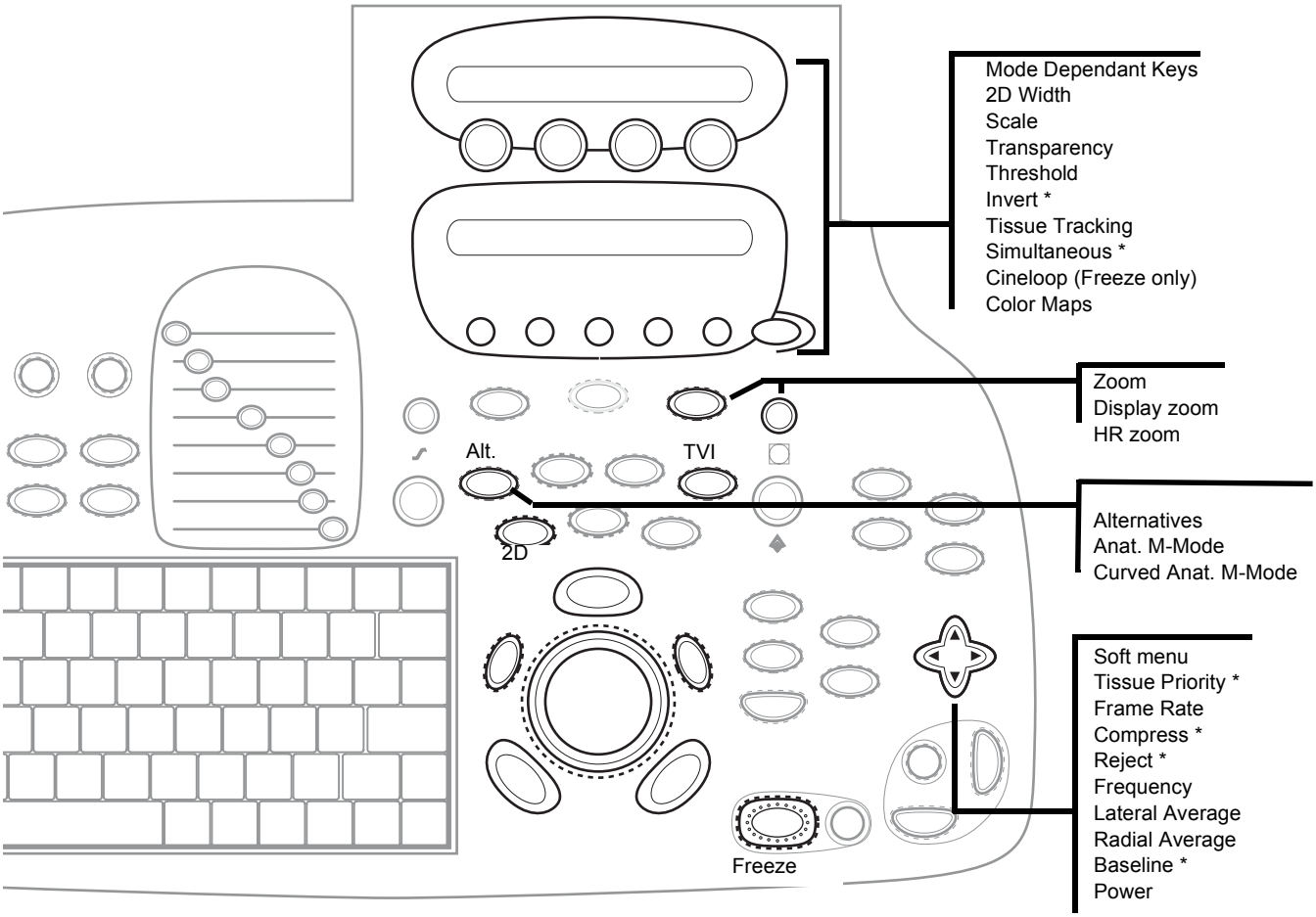
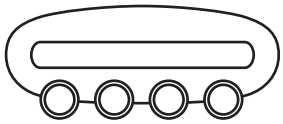
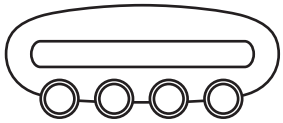
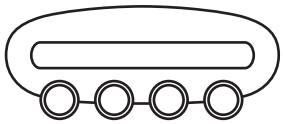
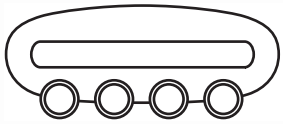


Figure 4-17 Doppler Mode Controls

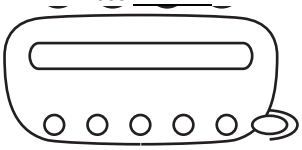
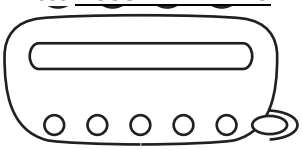
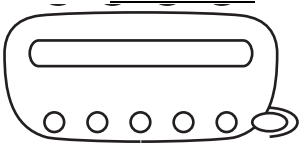
4-3-8-3 Check 2D Width, Scale, Transparency and Threshold

Table 4-23 TVI Mode Controls Checks

Step	Task	Expected Result(s)
1.	Adjust **2D WIDTH** 	Controls the size or angular width of the 2D sector.
2.	Adjust **SCALE** 	Controls the repetition rate of the Doppler pulses transmitted to acquire the data for color mapping. The scale value influences the Nyquist limit (the ability to detect maximal velocity without color aliasing.
3.	Adjust **TRANSPARENCY** 	Controls the degree of transparency of the TVI color.
4.	Adjust **THRESHOLD**. 	Controls the level of greyscale intensity that is used as a threshold for color.

4-3-8-4 Check Invert, Tissue Tracking, Simultaneous and Color Maps

Table 4-24 TVI Mode Controls Checks

Step	Task	Expected Result(s)
5.	Press **INVERT** 	Enables the color scheme assigned to positive and negative tissue velocities to be inverted. Invert is available in live and cine replay.
6.	Press **TISSUE TRACKING** 	Starts Tissue Tracking mode.
7.	Choose **COLOR MAPS** 	Displays a drop down menu of different colorization maps. Use the trackball to select the desired map and press Select to activate the map.

4-3-8-5 Check Tissue Priority, Frame Rate, Compress, Reject, Frequency, Lateral & Radial Average, Baseline and Power

Table 4-25 TVI Mode: Soft Menu Controls Check

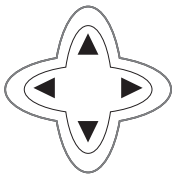
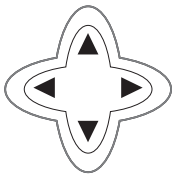
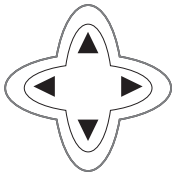
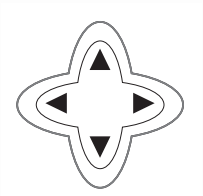
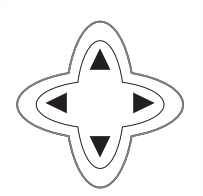
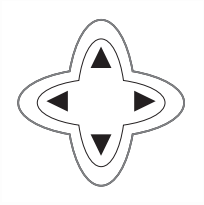
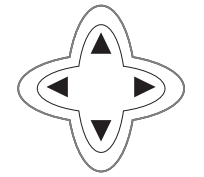
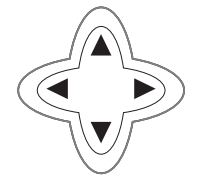
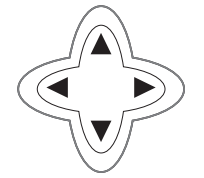
Step	Task	Expected Result(s)
8.	Adjust **TISSUE PRIORITY** 	Emphasizes either the color of the TVI or the greyscale tissue detail of the 2D image. Tissue priority is available in both Live and Freeze.
9.	Adjust **FRAME RATE** 	Controls the line density. When adjusting frame rate, there is a trade off between spatial and temporal resolution.
10.	Adjust **COMPRESS** 	Controls the amount of color compression. The color bar is adjusted accordingly.
11.	Adjust **REJECT** 	Adjust the cut-off level for the low velocity of TVI to be discarded when generating the color image.
12.	Adjust **FREQUENCY** 	Enables the adjustment of the transmission frequency to control the sensitivity or the level of penetration.

Table 4-25 TVI Mode: Soft Menu Controls Check

Step	Task	Expected Result(s)
13.	Adjust **LATERAL AVERAGE** 	Smooths the image by averaging collected data along the same horizontal line. An increase of the lateral averaging will reduce noise, but this will also reduce the lateral resolution.
14.	Adjust **RADIAL AVERAGE** 	Smooths the image by averaging collected data along the same radial line. An increase of the radial averaging will reduce noise, but this will also reduce the radial resolution.
15.	Adjust **BASELINE** 	Adjusts the color map to emphasize tissue motion either toward or away from the probe. Baseline is available in both Live and Freeze.
16.	Adjust **POWER** 	Controls the amount of acoustic power applied in all modes. When power is set to maximum, it is equal to or less than the maximum acoustic power level permitted by regulatory standards. The Thermal Index (TI) and the Mechanical Index (MI) are displayed on the screen.

4-3-9 Contrast Checks

Refer to Chapter 5 in Vivid 7 / Vivid 7 PRO User Manual.

4-3-10 Stress Echo

Refer to Chapter 4 in Vivid 7 / Vivid 7 PRO User Manual.

4-3-11 Measurements and Multi Image Checks

4-3-11-1 Introduction to Measurements & Analysis (M&A)

- A complete M&A software package for Cardiac is included in the Vivid 7 / Vivid 7 PRO.
- The M&A software runs on the Backend Processor.
- In this test, we just check one measurement, Calipers.

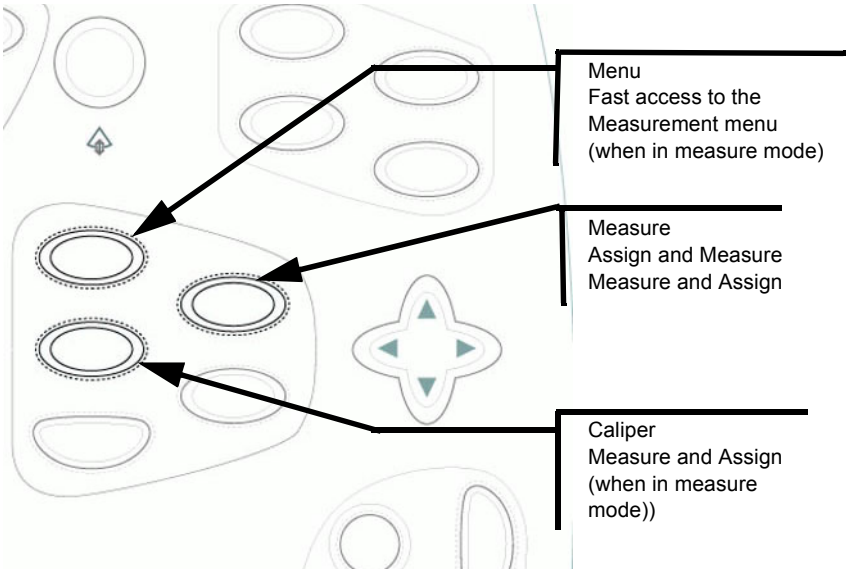


Figure 4-18 Measurement Keys

4-3-11-2 Preparations, M&A

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Table 4-26 Measurement Key Checks

Step	Task	Expected Result(s)
1.	Generate a 2D image (see 4-3-4 - 2D Mode (B mode) Checks for details).	A 2D image is active on the screen
2.	Press **FREEZE** on the Control Panel	The last scanned picture is on the screen.
3.	Scroll back until you find the picture you want to do the measurement on.	The picture of interest is on the screen.

4-3-11-3 Check Caliper Measurement, Distance

.

Table 4-27 Measurement Key Checks

Step	Task	Expected Result(s)
4.	Press **MEASURE** on the Control Panel. Select **Caliper** in the Measurement menu. or Press **CALIPER** on the Control Panel. Press the **CALIPER** assignable.	The Measurement menu with a list of studies is displayed in the Parameters window on the screen. When entering the Measurement mode for the first time, the Caliper tool is selected by default. When re-entering the Measurement mode, the first measurement in the actual study that has not been performed is selected by default.

Table 4-27 Measurement Key Checks

Step	Task	Expected Result(s)
5.	Use the Trackball to move the cursor to the start point of the measurement.	The cursor points to the start point for the measurement.
6.	Press **SELECT** to anchor the start point of the measurement.	The start point of the measurement is marked, and a line between the mark and the active cursor indicates the distance.
7.	Use the trackball to move the cursor to the end point of the measurement.	The current distance value is displayed in the Measurement result table and is instantaneously updated when moving the cursor.
8.	Press **SELECT** to mark the end point for the measurement.	The measurement display color on the 2D image changes from green to red after completion of the measurement. The measurement result is displayed in the Measurement result table.
9.	Trackball to the measurement result in the Measurement result table.	The highlighted parameter label is assigned to the measurement.

4-3-11-4 Check Post-measurement assignment labels

Table 4-28 Post-measurement assignment labels

Step	Task	Expected Result(s)
10.	Trackball to the actual measurement in the Measurement Result Window. Press **SELECT** on the Control Panel.	A Parameter menu is displayed.
11.	Trackball through the Parameter label menu to highlight the desired label. Press **SELECT** on the Control Panel.	The highlighted parameter label is assigned to the measurement.

4-3-12 Multi Image Checks

4-3-12-1 Introduction to Multi Image

This unit has a special function for displaying two or four examination pictures at the same time

Table 4-29 Use of Multi Image Key

Key	Description
	Enables multiple image display windows in which two or four images can be viewed simultaneously. When reducing the number of images, the active window will always be kept.

4-3-12-2 Preparations

Use a phantom when doing these tests.

1.) Connect one of the probes, to the scanner's left-most probe connector.
- See *Probe Connection*, page *3-13* for info about connecting the probes
- See *Probes*, page *9-28* for available probes

2.) Turn ON the scanner
- See 4-2-1 - Power ON/ Boot Up on page 4-2 for info about booting the scanner.

The 2D Mode window is displayed (default mode).

If needed, adjust the Display's Brightness and Contrast setting.

3.) Store four cineloops.

4-3-12-3 1,2,4 Key Check

Table 4-30 Multi Image Checks

Step	Task	Expected Result(s)
1.	Press the **1,2,4** Key once to display two images on the screen.	2 Images are displayed on the screen.
2.	Press the **1,2,4** Key once more to display four images on the screen.	4 Images are displayed on the screen.
3.	Press the **1,2,4** Key again to reduce the number of images on the screen.	1 image is displayed on the screen.

4-3-13 Probe/Connectors Check

NOTE: Probes can be connected at any time, whether the unit is ON or OFF

CAUTION **Take the following precautions with the probe cables:**
- Keep away from the wheels
- Do not bend
- Do not cross cables between probes

Table 4-31 Probe and Connectors Checks

Step	Task	Expected Result(s)
1.	Press **PROBE** on the Control Panel.	A list of the connected probes will pop up on the screen.
2.	If not already selected. use the trackball to select the desired probe.	An application menu for the desired probe is listed on the screen.
3.	Trackball to the desired application Press **SELECT** to launch the application. To change application without changing the current probe, press **APPL.** on the Control Panel.	The selected application starts.
4.	Verify no missing channels	All channels is functioning.
5.	Verify there's no EMI/RFI or artifacts specific to the probe.	No EMI/RFI or artifacts.
6.	Test the probe in each active connector slot. See “Probe Connection” on page 3-13.	It will display pictorial data each time
7.	Do a leakage test on the probe, See “Electrical Safety Tests” on page 10-10.	It passes the test.
8.	Repeat this procedure for all available probes.	

4-3-14 ECG Check

4-3-14-1 Introduction

The ECG capability on this unit, is intended as use as a trigger for measurements, but can also be viewed on the screen.

4-3-14-2 Parts needed

- ECG Harness, P/N:16L0026 + P/N:16L0028
- ECG Pads, (3 pc)

or

- ECG simulator

4-3-14-3 Preparations

None

4-3-14-4 ECG Check

Table 4-32 ECG Check

Step	Task	Expected Result(s)
1.	Connect the ECG harness to the connector on the front of the system	The unit displays a straight curve along the bottom edge of the image sector on the screen.
2.	Connect the three leads to a ECG simulator, or Fasten the three ECG Pads to your body and connect the three leads to respective ECG Pad	When connecting, the signal on the screen will be noisy When the connection is completed, a typical clean ECG signal is displayed.

4-3-15 Cineloop Check

4-3-15-1 Introduction

A cineloop is a sequence of images recorded over a certain time frame. When using ECG the time frame can be adjusted to cover one or more heart cycles. When frozen the System automatically displays the cineloop boundary markers on either side of the last detected heart cycle (Figure 4-19).

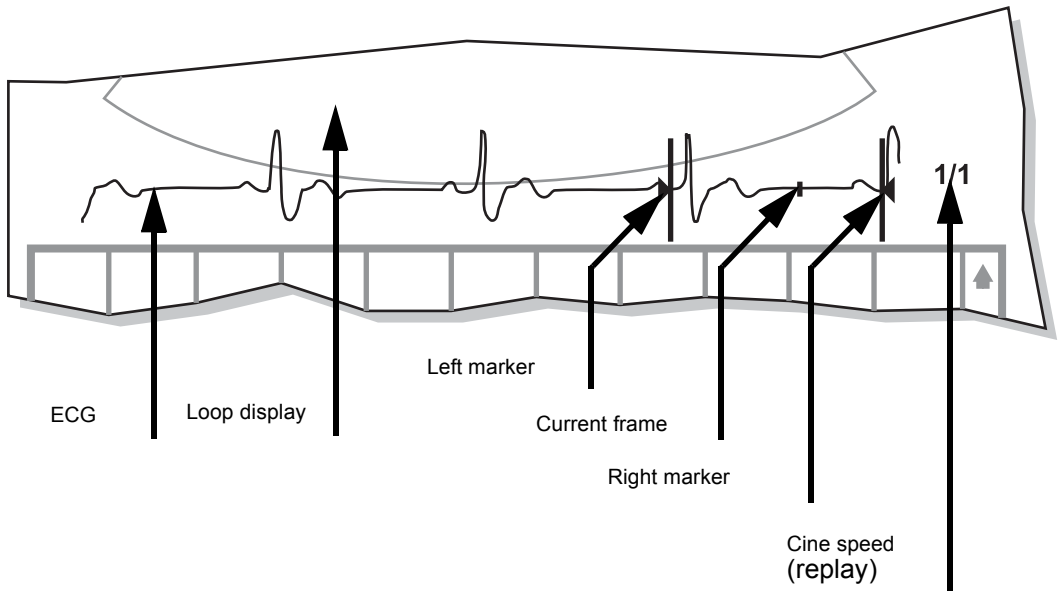


Figure 4-19 The Cineloop controls display

4-3-15-2 Preparation

Use a phantom when doing these tests.

1.) Connect one of the probes, to the scanner's left-most probe connector.
   - See *Probe Connection*, page *3-13* for info about connecting the probes
   - See *Probes*, page *9-28* for available probes

2.) Turn ON the scanner
   - See 4-2-1 - Power ON/ Boot Up on page 4-2 for info about booting the scanner.

   The 2D Mode window is displayed (default mode).

3.) Press **FREEZE**. to freeze the image.

4.) Press the Assignable **CINELOOP**.

4-3-7-2 Preparations (cont'd)

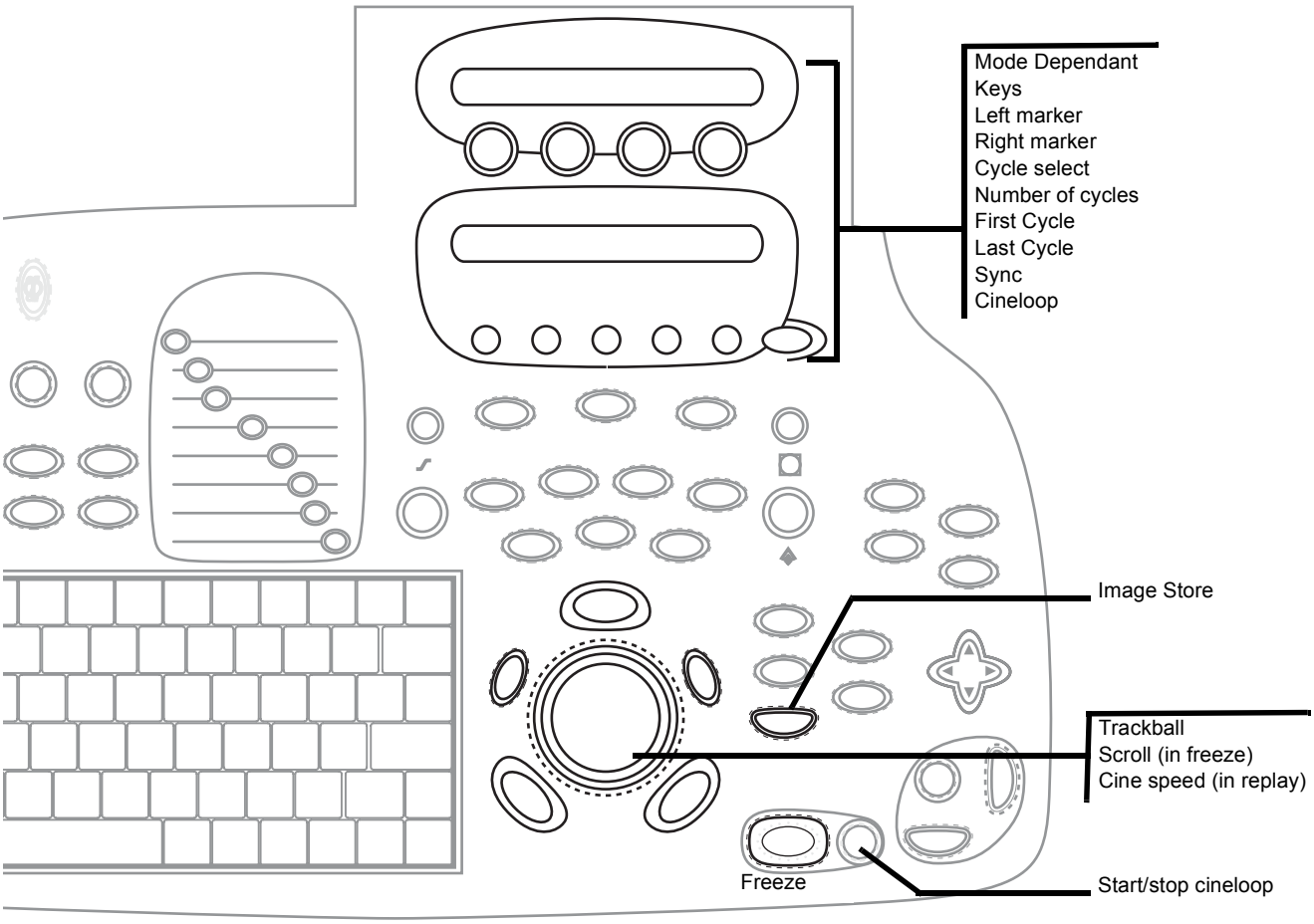
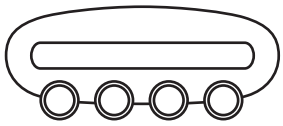
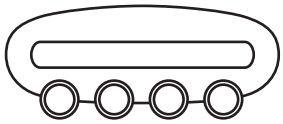
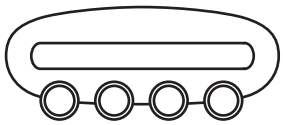


Figure 4-20 Cineloop controls

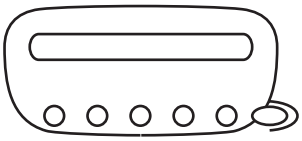
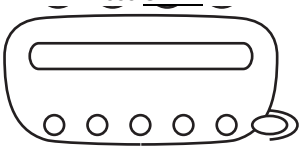
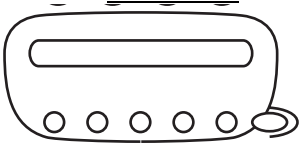
4-3-15-3 Check Left Marker, Right Marker, Cycle Select and Number of Cycles

Table 4-33 Cineloop Controls Checks

Step	Task	Expected Result(s)
1.	Adjust **LEFT MARKER** and **RIGHT MARKER** 	Moves the Left and Right Markers to expand or trim the cineloop boundaries.
2.	Adjust **CYCLE SELECT** 	Moves the cineloop boundaries from heart cycle to heart cycle.
3.	Adjust **NUMBER OF CYCLE** 	Increase or decrease the number of heart cycles to be included in the cineloop.

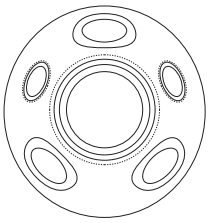
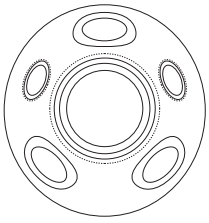
4-3-15-4 Check First, Last Cycle, Sync and Select all

Table 4-34 Cineloop Controls Checks

Step	Task	Expected Result(s)
1.	Press **FIRST** and **LAST CYCLE** 	Select either the first or the last heart cycle.
2.	Press **SYNC** 	Phase synchronize multiple loops.
3.	Press **SELECT ALL** 	Moves the cineloop boundaries to include all heart cycles.

4-3-15-5 Adjust Scroll and Cine Speed

Table 4-35 Cineloop Controls Checks

Step	Task	Expected Result(s)
1.	Adjust **Scroll** (in Frozen mode): Press **TRACKBALL** until the Scroll trackball assignable is selected. Use the Trackball. 	Move the current frame marker and review images.
2.	Adjust Cine Speed (in Cine Replay mode): Press **FREEZE** to freeze the image. Press **CINELOOP**. Roll the Trackball to the left. Roll the Trackball to the right. 	Step : the cine speed is decreased. Step : the cine speed is increased.

4-3-16 Backend Processor Checks

- If all the previous tests have been passed successfully, the Backend Processor is most likely OK.
- If the system seems to be operating erratically, please refer to Chapter 7 - Diagnostics/ Troubleshooting.

4-3-17 Peripheral Checks

4-3-17-1 Video Printers Checks

There may be both a black & white video printer and a color video printer on-board the system.

The Video Printers are controlled from the **PRINT** and **ALT.** keys on the scanner's Control Panel. The factory default is **PRINT** for the B/W Video Printer and **ALT.** for the Color Video Printer.

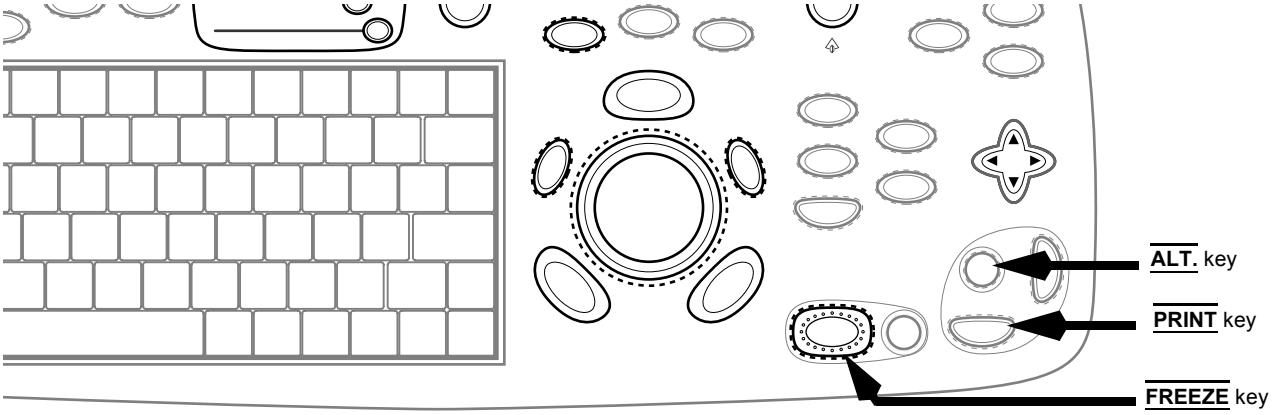


Figure 4-21 Freeze, Print 1 and Print 2 keys on the Control Panel

Table 4-36 Video Printer(s) Checks

Step	Task	Expected Result(s)
1.	When scanning in 2D Color Mode, Press **FREEZE** to stop image acquisition.	Image scanning stops with the last picture on the screen.
2.	Press **PRINT** on the Control Panel	The image displayed on the screen is printed on B&W or Color printer, depending on the key assignment configuration.
3.	Press **ALT**. on the Control Panel	The image displayed on the screen is printed on Color or B&W printer, depending on the key assignment configuration
4.	Check if the print quality on the pictures both from the printers are of expected quality.	

4-3-17-2 VCR Checks

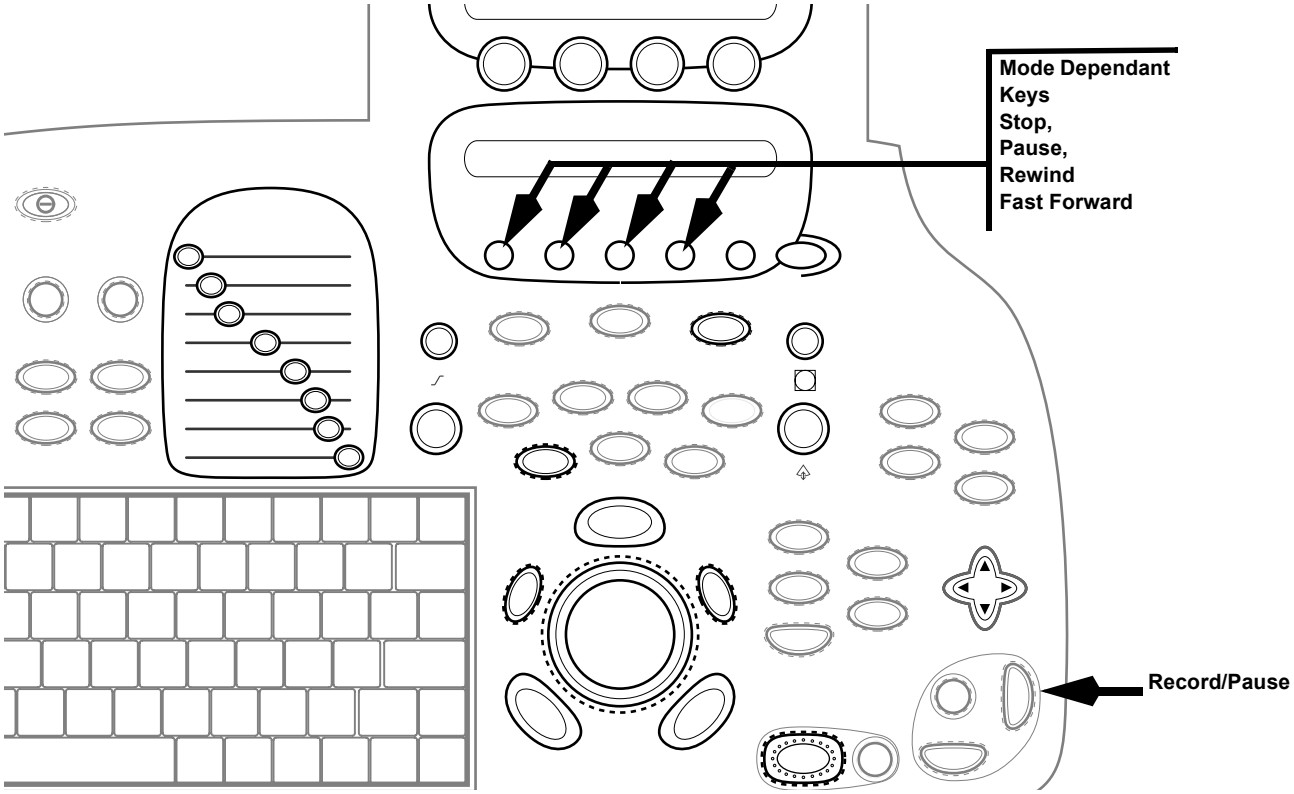


Figure 4-22 VCR Controls on the Control Panel

4-3-17-3 VCR Counter Check

When adding new examinations to a Video cassette, you can set the VCR Counter without rewinding the Video Cassette to the start. The procedure below explains how to check this function.

Prerequisite:

The VCR Counter number when the Video Cassette was Ejected last time.

. .

Table 4-37 VCR Counter Check

Step	Task	Expected Result(s)
1.	Insert the Video cassette in the VCR	
2.	Press **VIDEO** on the Control Panel.	To start the video counter at a different point:
3.	Press **UPDATE MENU** in the Trackball area.	The *Video Set Counter / Search Dialog window* is displayed
4.	Use the **alphanumeric keyboard** to enter the counter number (from last time) in the counter field.	Number appears on the screen
5.	Press **Set Counter** to save the change.	Number is saved
6.	Press **VIDEO** on the Control Panel, to return to scanning mode.	The system returns to the scanning mode

4-3-17-4 VCR Record Check

Table 4-38 VCR Checks

Step	Task	Expected Result(s)
1.	When scanning, press **REC/PAUSE** on the Control Panel.	The VCR starts recording. A red dot is displayed in the screen's VCR status area on the Title bar. It indicates that recording has begun
2.	Press **REC/PAUSE** on the Control Panel to stop recording.	The Recording stops. The video status icon on the screen is changed to (Pause)
3.	Note the counter meter setting on the VCR	.

4-3-17-5 Check Rewind, Fast Forward and Replay Video

Prerequisite:

A Video Tape in the VCR with at least one recorded examination.

Table 4-39 VCR Checks

Step	Task	Expected Result(s)
1.	Press **VIDEO** on the Control Panel.	The Mode Dependant Keys changes to VCR controls
2.	Press **REWIND** (Assignable Key)	The VCR starts to rewind the video tape.(observe the counter)
3.	Press **STOP** (Assignable Key)	The VCR Stops
4.	Press **FAST FORWARD** (Assignable Key)	The VCR starts the Fast Forward (observe the counter)
5.	Use the controls above to navigate to the start of the recorded examination. Then press **PLAY** (Assignable Key) to replay the recording	The replay of the examination starts.
6.	While in playback mode, use the **Trackball** to adjust the video playback speed and scroll through the record.	The replay of the examination responds according to your commands
7.	Press **PAUSE** to stop the tape at the desired frame.	The tape stops at the desired video frame.
8.	When playing back an examination	part of it can be stored on the computer's memory as a cineloop.The cine loop enables the user to perform further operations on the stored section (see for further information on cine loop operation).
9.	Press **FREEZE** while playing back a recorded session.	**To store a recorded sequence as a cine loop The** last few seconds are stored as a cine loop.

4-3-17-6 Check Cineloop from Video

Prerequisite

A Video Tape in the VCR with at least one recorded examination.

Procedure

. .

Table 4-40 VCR Cineloop Checks

Step	Task	Expected Result(s)
1.	When in video play back (of an examination), press **FREEZE**.	The last part of the video is stored in the computer's memory as a cine loop.
2.	Use the Trackball to move back and forth in the cine loop.	The Cineloop is played back according to your manipulating of the trackball.

4-3-17-7 Turn OFF Power to Vivid 7 / Vivid 7 PRO

See 4-2-2 - Power Shut Down on page 4-5.

4-3-18 Mechanical Functions Checks

4-3-18-1 Keyboard and Display Platform (Console) Checks


Label illustrates the functionality of the two handles
Handles for horizontal and vertical lock (up under the platform)

Figure 4-23 Console with handles

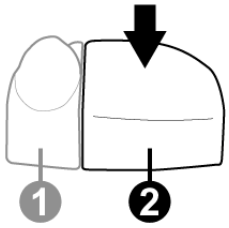
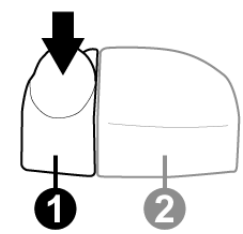
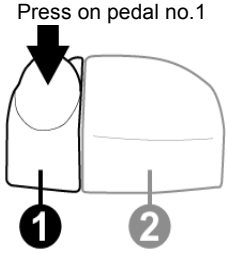
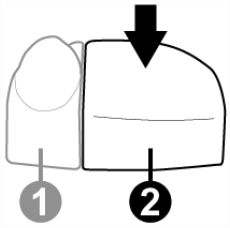
Table 4-41 Display Platform Maneuverability Checks

Step	Task	Expected Result(s)
1.	Pull handle up under the platform towards you to release horizontal lock	It is possible to maneuver the Display Platform horizontally at present level of height
2.	Pull handle at left hand grip towards you to release the Vertical Lock	It is possible to maneuver the Display Platform up and down (between the vertical end stops) as long as you pull the handle towards you
3.	Pull both handles towards you to release both Vertical and Horizontal locks	It is possible to maneuver the Display Platform both horizontally and vertically as long as you keep pulling these handles towards you

4-3-18-2 Brakes and Direction Lock Checks

Follow this procedure to verify that Brakes and Direction Locks function as intended.

Table 4-42 Brakes and Direction Lock Checks

Step	Task	Expected Result(s)
1.	Press on pedal no. 2 	To engage the brakes in full lock
2.	Press on pedal no.1 	To release the brake
3.	Press on pedal no.1 	To engage swivel lock. You may need to move the system around a little to get the wheels to lock into the locked direction.
4.	Press on pedal no. 2 	To release swivel lock

Section 4-4
Application Turnover Check List

Complete these checks before returning the scanner to customer for use:

4-4-1 Software Configuration Checks

Table 4-43 Software Configuration Checks

STEP	TASK	CHECK (✓)
1.	Check Date and Time setting	
2.	Check that Location (Hospital Name & Department) is correct	
3.	Check Language settings	
4.	Check assignment of Printer Keys	
5.	Check that all of the customer's options are set up correct	

Section 4-5
Power Supply

4-5-1 Power Supply Test Procedure

4-5-1-1 Introduction

There is no need to do any special tests on the Power Supplies if there don't seems to be a problem that may be related to the Power Supplies.

Refer to section 7-5-1 on page 7-67 if you appear to have a problem that may be related to the Power Supplies.

4-5-2 Power Supply Adjustment

There are no adjustments on the power supplyes. The DC Power is self-regulated. If a voltage is outside the specified range, it means that something is wrong, either with the power supply itself or with a unit connected to that specific power outlet.

Section 4-6
Site Log

Table 4-44 Site Log

DATE	SERVICE PERSON	PROBLEM	COMMENTS

Table 4-44 Site Log (continued)

DATE	SERVICE PERSON	PROBLEM	COMMENTS

Chapter 5
Components and Functions (Theory)

Section 5-1
Overview

5-1-1 Purpose of Chapter 5

This chapter explains Vivid 7 / Vivid 7 PRO's system concepts, component arrangement, and subsystem functions. It also describes the Power Distribution System (PDS).

Table 5-1 Contents in Chapter 5

Section	Description	Page Number
5-1	Overview	5-1
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5-3	Front End Processor	5-4
5-4	Back End Processor	5-14
5-5	Patient I/O (Physio)	5-23
5-6	Internal I/O	5-24
5-7	Top Console	5-31
5-8	Peripherals	5-32
5-9	Modem	5-33
5-10	Power Distribution	5-34
5-11	Circuit Boards	5-44
5-12	Video Specifications	5-95
5-13	System Logs	5-95
5-14	Board Rack Cooling System	5-96
5-15	Top Console Movement	5-97
5-16	Common Service Platform	5-101

Section 5-2
General Information

Vivid 7 / Vivid 7 PRO is a phased and linear array ultrasound imaging scanner. The system is versatile and can be used for a number of various applications; all a matter of software.

The system can be used for:

- 2D Grey Scale and 2D Color Flow Imaging
- M-Mode Grey Scale Imaging
- Color M-Mode
- Doppler
- a number of combinations of the above

A Physio module is incorporated in the Backend Processor (BEP) to provide ECG signals to synchronize cardiac ultrasound image acquisition. Additionally other analog inputs (e.g. ECG, phono) from devices such as treadmills are processed.

Vivid 7 / Vivid 7 PRO is a digital beamforming system which can handle up to 192 element linear probes by use of multiplexing.

Signal flow travels from the Probe Connector Panel to the Front End Electronics, to the Back-End Processor, and finally displayed on the monitor and peripherals.

System configuration is stored on a hard disk and all necessary software is loaded from the hard disk on power up.

- The user initiates system operation via the Operator Panel which contains a keyboard, control panel, TGC and LCD display.
- Vivid 7 / Vivid 7 PRO internal electronics are divided into two card cages;
  - Front End Processor (FEP) Sometimes called “Card Cage” in this manual.
  - Backend Processor (BEP)
- Interconnecting signals from the FEP, BEP, Operator Panel, Monitor and Power distribution subsystems are routed via cables and circuit boards IIO (Internal I/O) and EIO (External I/O). The main functional blocks in Vivid 7 / Vivid 7 PRO are:
  - Front End Processor (FEP)
  - Back End Processor (BEP)
  - Top Console
  - Power Distribution
  - Internal I/O
  - External I/O
  - Peripherals
  - Modem

5-2-1 Block Diagram

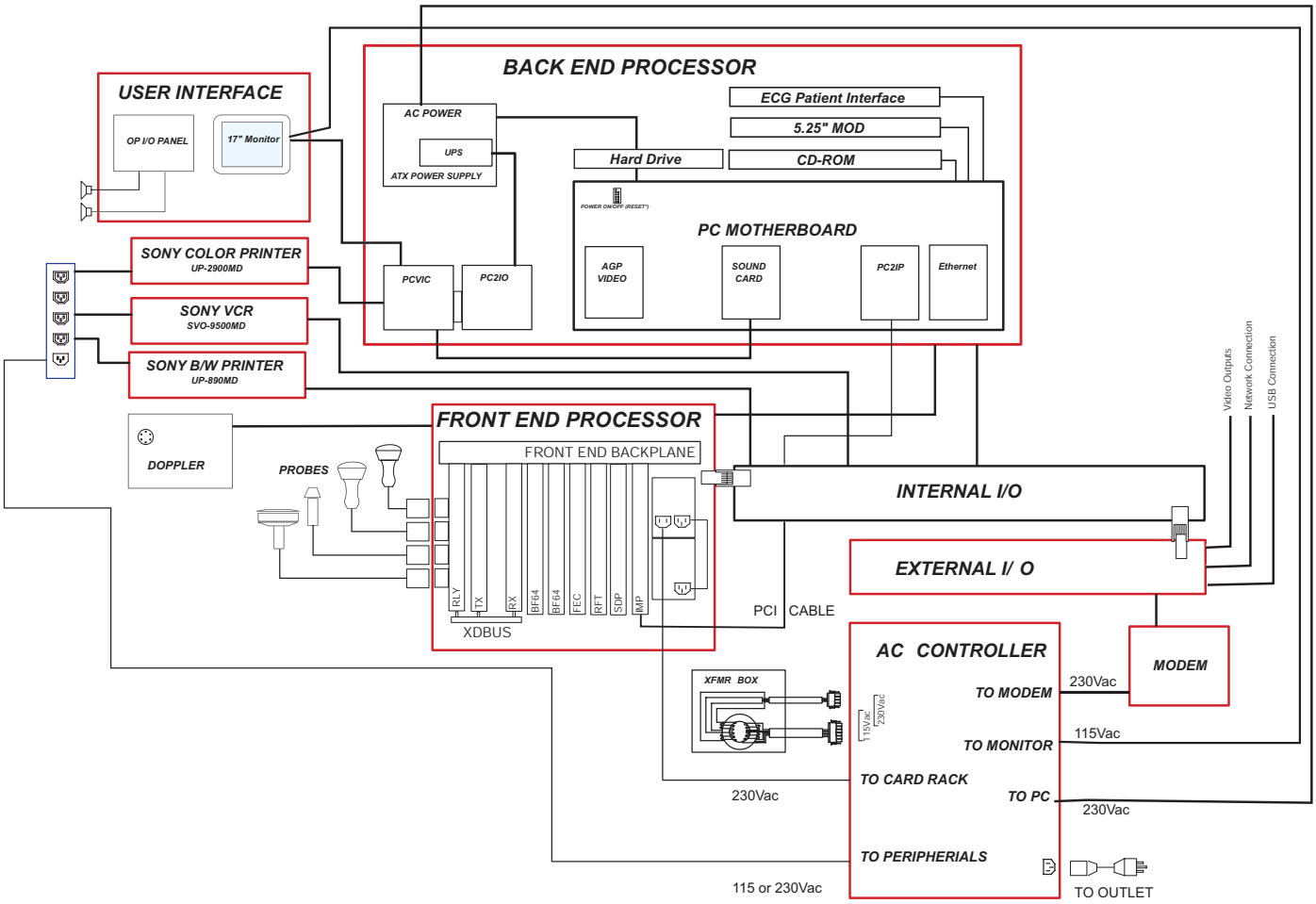


Figure 5-1 Vivid 7 / Vivid 7 PRO Simple Block Diagram

Section 5-3
Front End Processor

5-3-1 General Information

The Front End Processor includes all of the boards in the Front End Card Rack:

- RLY (Relay Board)
- TX (Transmitter Board)
- RX128 (Receiver Board)
- BF64 (Beamformer Boards) (2x)
- FEC (Front End Controller Board)
- RFT (Radio Frequency & Tissue Board)
- SDP (Spectrum Doppler Processor)
- IMP2 (Image Port 2)

The Front End can be divided into two subsystems:

1.) The Front End subsystem includes the:
   - RLY (Relay Board)
   - TX (Transmitter Board)
   - RX128 (Receiver Board)
   - BF64 (Beamformer Boards) (2x)
   - FEC (Front End Controller Board)

2.) The Mid Processors subsystem include:
   - RFT (Radio Frequency & Tissue Board)
   - SDP (Spectrum Doppler Processor)
   - IMP2 (Image Port 2).

5-3-2 Front End Bus

Most of the FE boards are controlled by the Front End Controller board via a Front End Bus (FE_BUS). The FE_BUS is a synchronous and bidirectional bus built up by 16-bit data, 6-bit device address select, 10-bit page address and 8 strobe signals controlling the data transactions. The Front End Controller board can also read the revision status of the Front End boards through a serial line to a E^2PROM located on each board.

5-3-3 Phased and Linear Array Front End

- The phased and linear array probes consist of several identical transducer elements (e.g. 64, 128, 192). Three probes can be connected to the system. The connectors are physically located on the RLY board, where one of them is selected and connected to the transmitter (TX) and receiver (RX) through a number of relays.
- Depending on probe type and system setup, a certain scan pattern is selected on the FEC board. This board loads scan parameters for both the transmitter and the beamformer (steering- and focusing delays) into local RAM on these boards. Thus, when the FEC board goes through a scan sequence, it loads the proper contents of the RAM into the Transmitter Puls Generator (TPG), then issues a transmit trigger pulse (TXTRIG_L) for the transmitter and a receive synchronization pulse (SYNC_L) for the beamformer. By firing the transmit pulses from the different elements at certain repeated time intervals and with different delays, the ultrasound beam can be steered in desired directions (re. principles of operation) obtaining the selected scan patterns (e.g. 2D, 2D Flow etc.).

5-3-3 Phased and Linear Array Front End (cont'd)

- The ultrasound transmit bursts are generated on the TX board, initiated by the transmit trigger pulse (TXTRIG_L). The transmit trigger starts the Transmit Pulse Generators (TPG) on the TX board, each generating 16 transmit pulses with different delays. The transmit pulses are then routed to separate transmit "amplifiers" fed with voltage HV1 and HV2 witch are controlled by the Acoustic Power control software.
- The transmit pulses are routed over an Xducer Bus Board (XDBUS) located on the front side of the Front End boards, to the Relay board, where they are fed to the selected (one out of three) phased/ linear array probe.
- The reflected signal from body structures and blood cells are routed from the probe, via the Relay board over the Xducer Bus to the RX (receiver) board, where preamplification (20dB) and Analog Time Gain Compensation (ATGC) (-10 - +30 dB) is performed. Gain is determined by an analog signal (ATGC) generated by the FEC board.
  On the very input of the RX board are transmit/receive (T/R) switches to prevent the transmitters from destroying the receivers. Prior to preamplification the signals from the different channels were also fed through relays. This is for having the possibility to route echoes from annular array probes into the receiver, in addition to injecting a test signal, TSIG.
- The output channels from the RX board are fed to two Beamformer-64 boards. Each Beamformer board performs A/D conversion of 64 channels.
- The Front End Controller board controls all Front End boards. The board loads all parameters to the TX and Beamformer RAMs, it reads the probe identification, selects probe connector on Relay board and controls the high voltage multiplexer in linear probes. In addition the board generates the transmit trigger pulse for TX, a receive synchronization pulse (SYNC_L) used by Beamformers and RF & Tissue Processor, a differential ATGC voltage used by RX and control signals for the High Voltage Power Supply (HV POWER). The Front End Controller board also generates the global 40 MHz system clocks and reset pulse (SRES).
- The output from the Beamadders at BF#2 is fed to the RF and Tissue Processor Board (RFT).

5-3-4 Transmitter Power Supply

The transmitters on the TX board are fed with high voltage from the TX supply. This module consists of three linear power supplies; one providing a symmetrical output voltage ranging from 0 to +/- 80 V (HV1), the other providing a voltage ranging from 0 to +/- 40 V (HV2) and the third outputting +/- 80 V for the multiplexers in the linear probes. HV1 and HV2 are programmable through a serial interface from the FEC board.

5-3-5 Mid Processors

The Vivid 7 / Vivid 7 PRO Front End and visualization system are interconnected through digital signal processing modules, called the Mid Processors. These processors performs the adequate signal conditioning for the different data types; Tissue, Doppler and Flow. The current Mid Processors are the RF & Tissue Processor board (RFT), the Spectrum Doppler Processor board (SDP).

5-3-5-1 Pipelink bus

- The Mid Processors are interconnected through a data bus system called the Pipelink. This is a unidirectional bus transporting data from the pipelink dispatcher (RF & Tissue Processor) through the accessed processor to the destination, the Image Port. The Image Port will then map the data into the Image Memory.
- Data leaving the RF & Tissue Processor have a tag indicating what type of data that is transported; e.g. tissue, Doppler, 2D Flow. Each of the remaining mid processors decode this tag and when it matches their own address, the data is processed. Data that doesn't have a matching tag, is passed on to the next processor.
- In 2D, data is typically transferred in vector blocks from the RFT board. In spectrum Doppler and Color Flow, data from one range gate is transferred.

5-3-5-2 RF and Tissue Processor (RFT)

The RF & Tissue Processor board receives its data from the Beamformer board in the Front End. Both type of data and what data samples (RF_MODE) to use are communicated to the RFT board from the Front End Controller board (over the Front End Bus).

RF Processing

Different types of RF processing can be performed depending on later usage of the data; e.g.:

- RF Demodulation
- Digital Time Gain Compensation
- Filtering
- Decimation.

Data Buffer

After RF filtering, the data is written into different sliding ring buffers, dedicated the different types of data. While data is written into the buffers sample by sample in vectors, multiple samples from the same range (depth) can be read out.

Both input addressing (start and length) and output addressing (through output events) is controlled by the Front End Controller board.

Tissue Processing

A number of different tissue processes are performed on this board:

1.) First the signal amplitude is obtained by detection.
2.) Then the data is compressed to attenuate the strong signals and amplify the low level echoes.
3.) After compression, Zone Stitching is performed. This is used to combine the (transmit) focal zones from different vectors into one vector by weighting the zone transitions, and does only apply to phased/linear array probes where multiple vectors can be collected in the same direction. For M-Mode, peak detection and edge enhancement is implemented.
4.) Finally an offset can be added to the signal and clipping is performed.
5.) The tissue data is then tagged, and sent on to the Image Port board.

Color Flow Processing

No Color Flow processing is performed here, except for the RF demodulation previously mentioned. The data used for Color Flow is tagged with the appropriate headers and tails and routed through an output multiplexer to the Backend Processor (BEP).

Doppler Processing

In addition to RF demodulation, a variable digital high pass filter is implemented on the RFT board.The purpose of this filter is to remove strong low frequency signals returning from wall motion, valves and leaflets. The filtering is performed by the local DSP. Data is then tagged and sent to the Spectrum Doppler Processor board.

5-3-5-2 RF and Tissue Processor (RFT) (cont'd)

Control

The RFT board has a local Digital Signal Processor (DSP) with an external EPROM.

The DSP performs multiple control tasks:

1.) It handles communication with the BEP over the VME bus.
2.) It updates filter coefficients and other parameters in the data path.
3.) When output events from the Front End Controller is received, it sets up the Pipelink output control for data tagging and transfer.
4.) During transfer of time motion data, it sets up a *time-slot* data transfer (which replaced the output event based transfer).

5-3-5-3 Spectrum Doppler Processor

The Spectrum Doppler Processor board (SDP) receives its data from the RFT board. In Pulsed Wave (PW) Doppler several sets of data from the same range (depth) originating from different transmit pulses are transferred from RFT data buffer. In Continuous Wave (CW) Doppler the data samples are transferred consecutively.

Spectrum Analysis

The data sets are written into a sliding ring buffer with different ranges along the vertical axis and different transmit pulses along the horizontal (time) axis, thus achieving a two-dimensional matrix. By reading the data out of the buffer in a certain way (re. Principles of Operation) and performing Discrete Fourier Transform on the data, velocities up to seven times the pulse repetition frequency (in PW) can be displayed. Parts of the spectral analysis is done by a digital signal processor (DSP1).

During Duplex modes (e.g. 2D and Doppler) the gaps in the spectrum (when doing 2D) is filled by stretching the "real" spectrum out to fill the missing time.

Audio

The Doppler audio channels (I and Q, or DOPLA and DOPLB) are generated based upon the digital data stored in the ring buffer. The data is transferred from the buffer into DSP2 (Digital Signal Processor no. 2) which controls the D/A conversion as well as the Missing Signal Estimation of audio in Duplex modes.

Trace Interface

A serial link from the Internal I/O board, feeds several A/D converted traces (like ECG, phono, pressure) into the Spectrum Doppler Processor board.

These traces as well as spectral data, are tagged and transported over the pipelink to the Image Port under control of DSP1.

Control

The DSP1 controls the data flow and updating of all parameters, including control of read/write address generation. It communicates with the BEP over the VME bus and provides the pipelink output with spectrum and trace data.

5-3-5-4 Image Port

The purpose of the Image Port is to capture signal processed data from the Mid Processors or video data from the VCR, and route this data to the appropriate locations.

Data from Mid Processors

1.) Data from the RFT Card and the SDP Card are transferred over the PipeLink in data packages called Frames, Packets and Tuplets, all depending on size of the package.
2.) At the Image Port the Packet is collapsed. A Frame contains enough data to construct one frame (e.g. one 2D frame), while one Tuplet contains enough data to construct one vector (e.g. one Color vector). The size of the vectors will depend on data type.
3.) The Image Port demultiplexes the different types of data, groups the same types and maps them into the proper ring buffers in the Image Memory located on the Image Port 2 card.

Data from VCR

1.) Video and S-VHS (both in PAL and NTSC format) from the VCR (or another video source) is first digitized and then fed through a video multi-standard decoder providing decoded luminance (black and white) and chroma (color) data.
2.) Data is then transferred to a ring buffer in the image memory where it later can be fetched by Scan Converter for display on the system monitor.

Memory

Typically size of the Image Memory is 256 MBytes.

The Image Port board is the data source and the BEP is the data destinations.

Up to eight of the data sets below can be stored live simultaneously in the Image Memory in eight different ring buffers.

- 2D Tissue data
- Doppler data
- M-Mode Tissue data
- 2D Flow data
- M-Mode Color data
- Trace data
- Video Luminance data
- Video Chroma data
- RF data

5-3-5-5 Internal I/O and Peripheral Control

The Internal I/O board performs buffering and distribution of video and control data from various sources to multiple destinations.

- SVGA (R, G, B and Sync.) are fed from the BEP, directly up to the system monitor. Another set of RGB can be fed to a color printer.
- Composite video, black and white video and S-Video are buffered and distributed to VCR and printers.
- The analog Doppler signals are fed from the Spectrum Doppler board to the VCR audio inputs and through a switch where audio from VCR playback also is input, to the BEP and then to the speakers.
- Serial RS-232 interface signals from the BEP are fed to the destinations; VCR, Color Printer and Modem.
- Serial USB interface signals from the BEP are fed to the Front Panel and to EIO.
- Remote control signals for printers are generated on the I/O board.
- The Footswitch is connected to the I/O board.
- An AC Power Interface controls power on/off and fan speed.

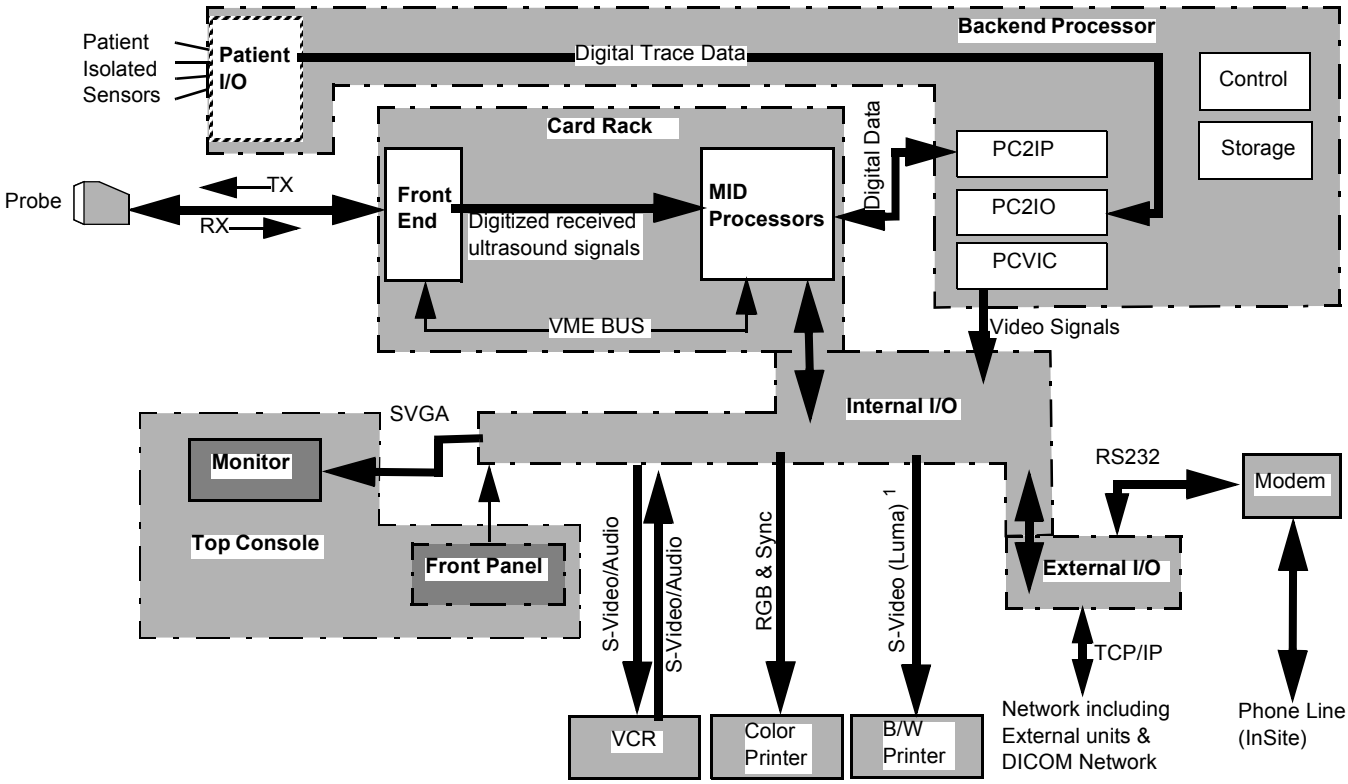
5-3-5-6 External I/O

Several signal are fed from the Internal I/O board to an External I/O board located on the rear of the system. This board contains data buffers and a galvanic isolation section.

Different types of signals are fed to connectors accessible on the External I/O.

- R, G, B and Sync are provided for external RGB monitors or printers.
- Composite video, black and white video and S-VHS video are buffered and fed to output connectors for external monitors and printers.
- Two serial RS-232 ports are provided for external communication with e.g. the System CPU.
- An Ethernet signal from the BEP is fed to an Ethernet connector. It is used for connectivity, including DICOM Network.

5-3-5-6-1 System Block Diagram



1) S-Video (Luma) is the Luma (Black/White) part of the S-Video signal

Figure 5-2 Block Diagram, Vivid 7 / Vivid 7 PRO

5-3-6 Major Sub-Systems in Vivid 7 / Vivid 7 PRO

The following Sub-systems make up the Vivid 7 / Vivid 7 PRO:

- Front End Subsystem
- Mid Processors
- Back End Processor
- Patient I/O (Physio) (with ECG and Physio)
- Internal I/O
- External I/O
- Top Console (with monitor)
- Peripherals
- Modem

5-3-7 Front End Subsystem

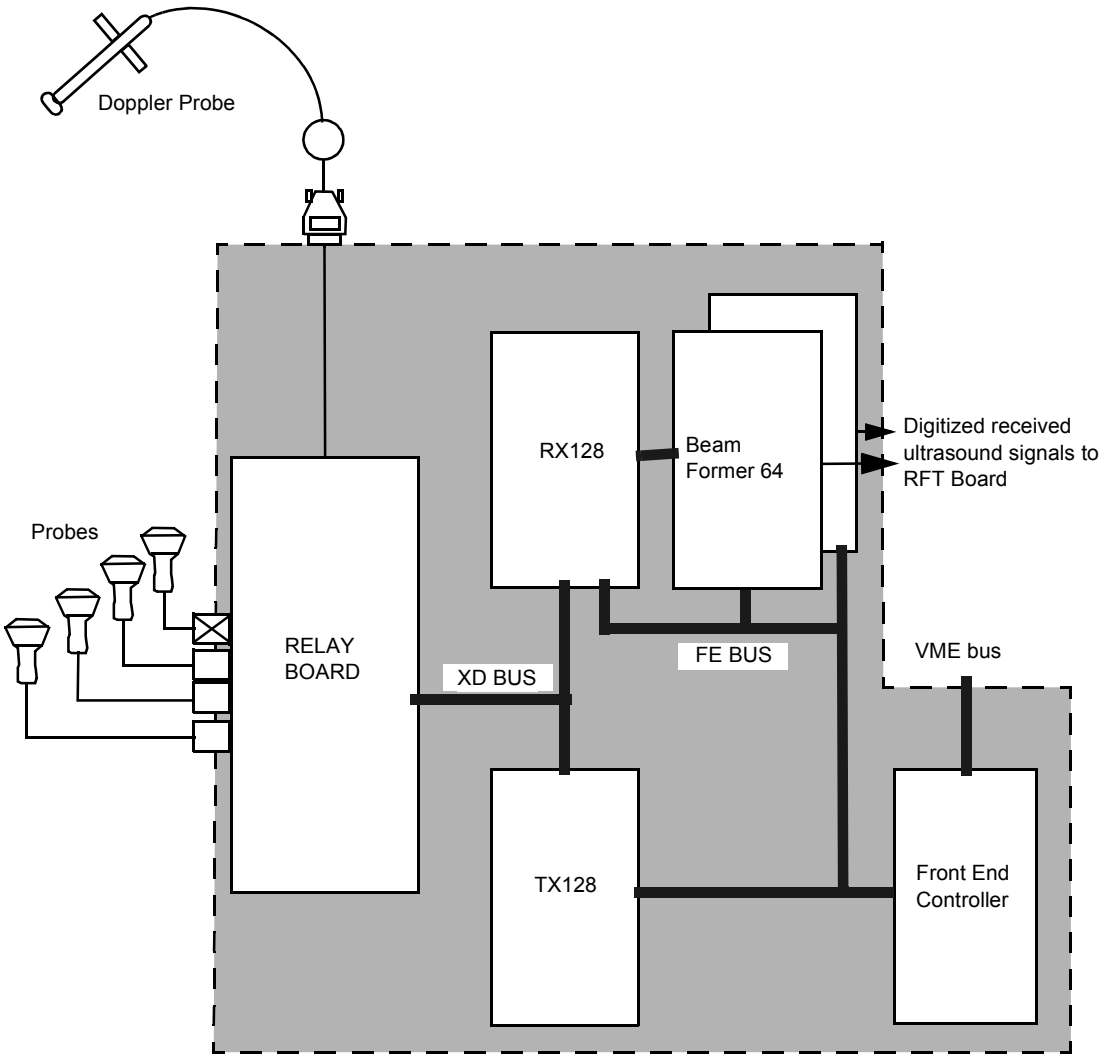


Figure 5-3 The Front End

The Front End section performs the transmit and receive functions.

- The Front End Controller controls the ultrasound transmitter and receiver synchronization.
- The TX128 board makes the ultrasound transmit pulses.
- The RX128 board is the ultrasound receiver for the ultrasound echoes from blood/tissue.
- The two Beamformer boards digitizes the received ultrasound signal and sends it to the Mid Processors.
- The Relay board is the interface between the Probes and the Front End.

5-3-8 Mid Processors

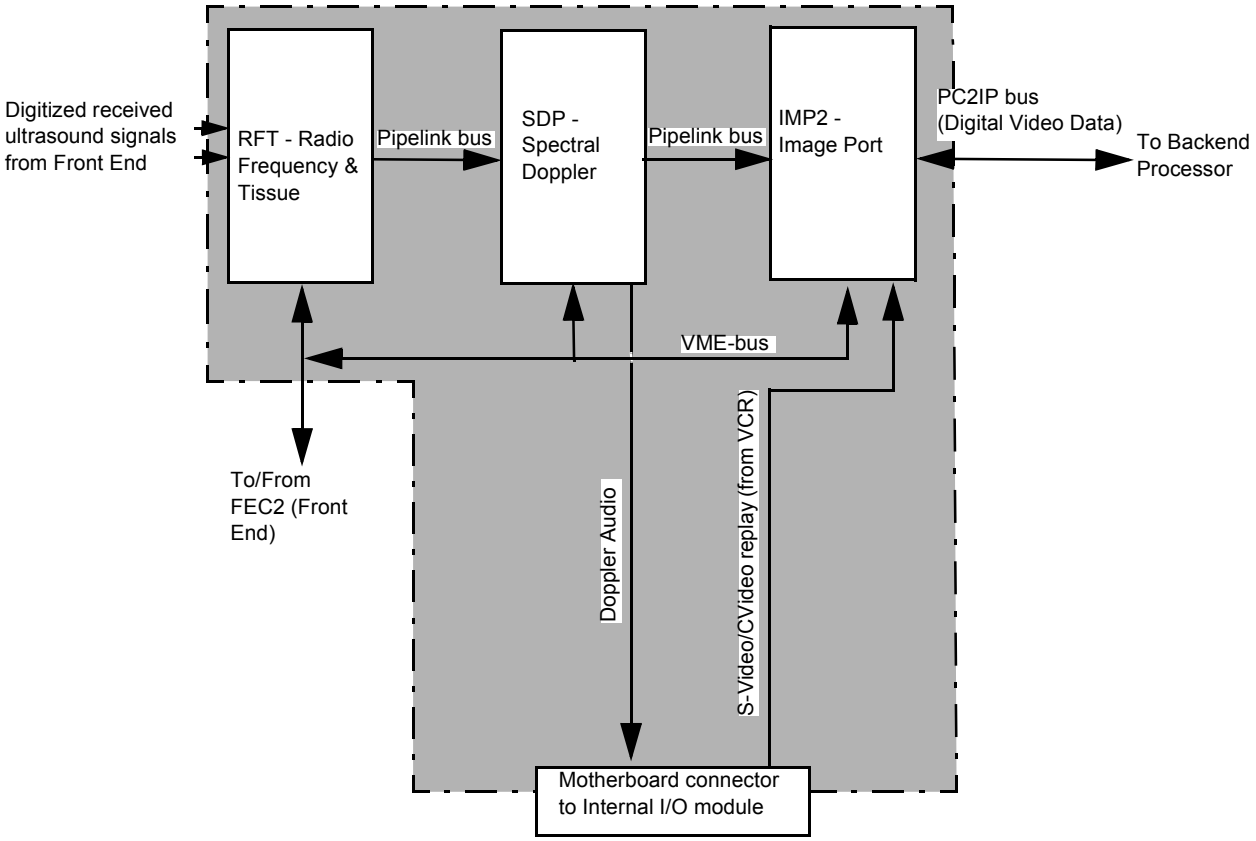


Figure 5-4 The Mid Processors

This Mid Processors performs the signal conditioning for Tissue and Doppler.

Color Flow processing is done by the Backend Processor.

The Radio Frequency & Tissue (RFT) board, the Spectral Doppler (SDP) board and the Image Port (IMP2) board are located in the Front End Processor Card Rack.

- The RFT board receives digitized ultrasound signals from the Front End and performs the RF filtering and tissue processing. The result is sent via the Pipelink bus to SDP.
- The SDP board receives digitized Doppler data via the Pipelink bus, performs the pulsed and continuos Doppler processing and produces Doppler Audio. The processed Doppler result is sent via the Pipelink bus to IMP2. The Doppler Audio is routed via the Motherboard to the Internal I/O.
- The main functions of the Image Port (IMP2) board:
  - Capture data from the RFT or the VCR (in playback), store it into its internal memory and then route it to the BEP via the PC2IP bus.
  - Pick Color Flow data from the Pipelink bus and send it to the BEP via the PC2IP bus.
  - Main Communication between BEP and the cards in the Card Rack (via the PC2IP Bus).

Section 5-4
Back End Processor

5-4-1 Introduction

The Back End Processor is a computer designed specially for the use in Ultrasound Scanners made by GE. The first version, called BEP-1 in this manual, has been used since the introduction of the Vivid 7 / Vivid 7 PRO ultrasound scanners. A new version, called BEP-2 in this manual, will be introduced second half of 2002 as a replacement for BEP-1, both for new ultrasound scanners from factory and for service replacement in the field.

When the descriptions in this section applies only to one of the models, it will be marked in the text (BEP-1 or BEP-2)

5-4-2 Signal Flow and Processing

The Back End Processor receives the data from the Front-End Electronics, stores it in memory, performs scan conversion to pixel domain, and drives the system RGB monitor.

Back End Processor software is also providing processing of Color Flow, Doppler, and M-Mode Data.

See Figure 5-6 "CPU/Backend Processor Block Diagram (BEP-1)" on page 5-15 for an overview of the Back End Processor.

5-4-3 Location of the Back End Processor

The BEP is located on the left side, inside the scanner. The cover on the left side has been removed in Figure 5-5 "Backend Processor Mounted in Scanner (BEP-1 shown)" on page 5-14.

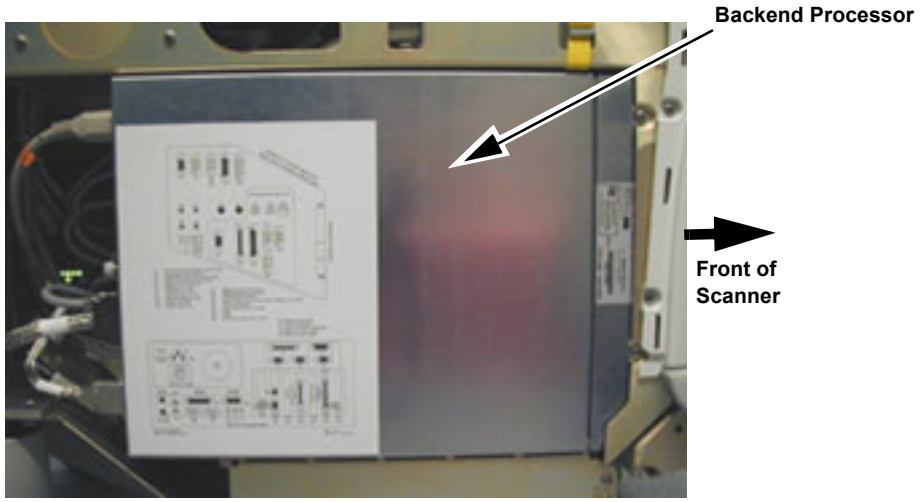


Figure 5-5 Backend Processor Mounted in Scanner (BEP-1 shown)

5-4-4 BEP-1 Block Diagram

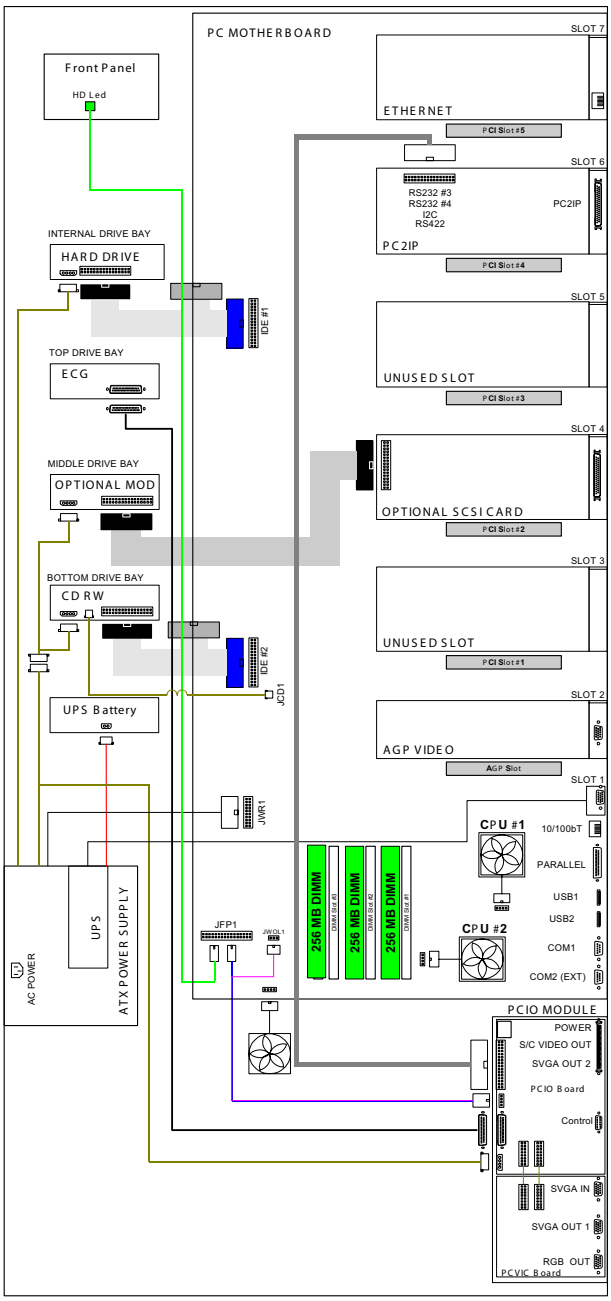


Figure 5-6 CPU/Backend Processor Block Diagram (BEP-1)

5-4-5 BEP-1 Description

NOTE: Specifications mentioned about the Back End Processor (BEP-1) is minimum requirements. The actual hardware could exceed these specifications as technology advances.

The EMC enclosure houses an ATX Power Supply with UPS battery backup, an ATX style motherboard with minimum of 512 MB of ram and two 733 MHz processors

5 PCI slots on the mother board contains the following:

1.) Blank
2.) Optional SCSI Card for MO Drive
3.) Blank
4.) PC2IP Card - GE designed. PCI Bus interface to the Front End Processor
5.) Network Interface Card - 3Com Ethernet Card

- Analog output complies with the SVGA specification.
- Resolution (on monitor) is 800x600.
- Support for 32 bit True Color
- Minimum of 8 Mbytes of high speed Video RAM, expandable to at least 16 Mbytes.
- 128-bit internal memory interface.
- Hardware supported asynchronous bit block transfer (80 Mpixels/sec).
- Power and Internal PCI control signals
- Two (2) USB Ports

5-4-6 BEP-2 Block Diagram

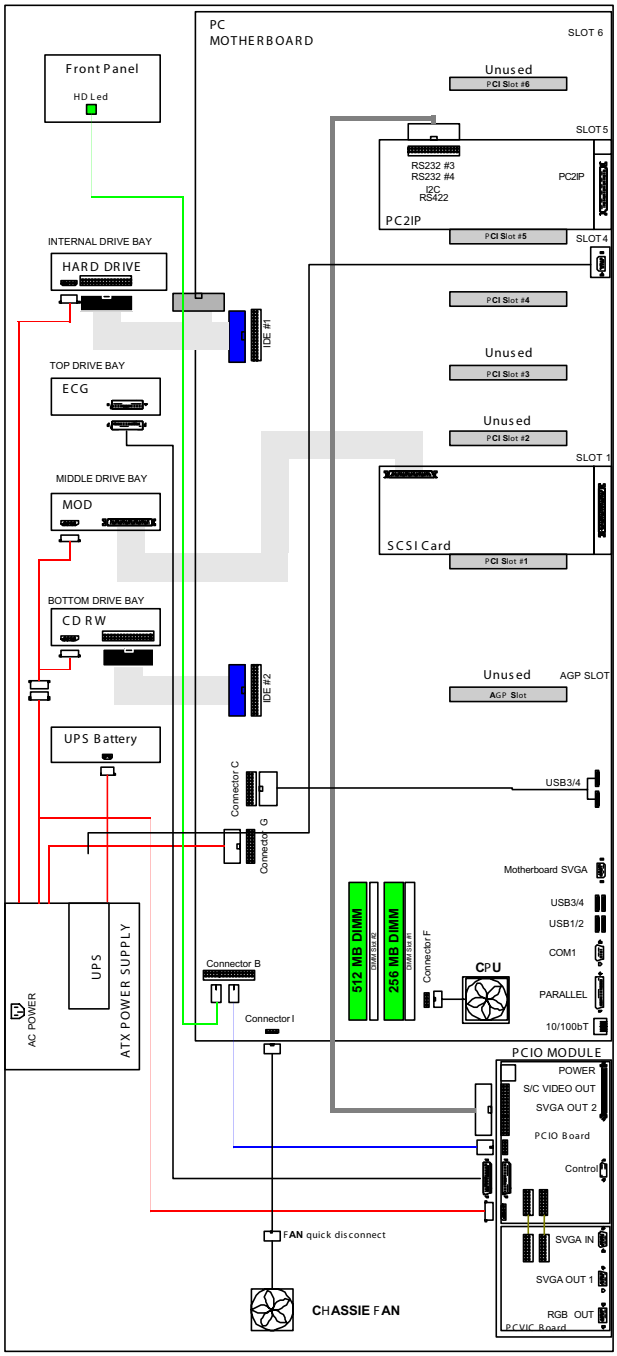


Figure 5-7 CPU/Backend Processor Block Diagram (BEP 2)

5-4-7 BEP-2 Description

NOTE: Specifications mentioned about the Back End Processor (BEP-2) is minimum requirements. The actual hardware could exceed these specifications as technology advances.

The EMC Enclosure House

- A Power Supply with UPS battery backup,
- An Intel Motherboard with 768 Mbytes of ram and a single 2.0 GHz P4 processor w/ 400 MHz FSB.
- Six (6) USB Ports
- One (1) Serial Port (COM1 used for modem connection)
- USB to Serial adapter cable (USB #3 to II/O B7) for External I/O serial output
- AGP Video output from the motherboard (AGP Card Slot empty)
- LAN output from the motherboard (PCI Card Slot 6 empty)

Use of 5 PCI slots on Mother Board

1.) Blank
2.) Optional SCSI Card for MO Drive
3.) Blank
4.) PC2IP Card - GE designed. PCI Bus interface to the Front End Processor
5.) Blank

- Analog output complies with the SVGA specification.
- Resolution (on monitor) is 800x600.
- Support for 32 bit True Color
- Minimum of 8 Mbytes of high speed Video RAM, expandable to at least 16 Mbytes.
- 128-bit internal memory interface.
- Hardware supported asynchronous bit block transfer (80 Mpixels/sec).
    - Power and Internal PCI control signals

5-4-8 PCVIC Card

- SVGA output to the monitor
- RGB output to color printer

5-4-9 UPS Battery Operation

The UPS batteries provide power to the Back End Processor to enable a controlled shut down of the processor.

The UPS batteries will drain slightly when the system is in the off condition.

The off condition is defined as:

- Circuit Breaker in the OFF position
- System unplugged from the wall outlet

If the system is left in the OFF condition for an extended period of time (3 to 5 days or more), the system may not boot up or may beep when turned ON. Should this occur, the system needs to recharge the UPS batteries. This could take 15 minutes to as long as 24 hours, depending on the battery age, system input voltage and system temperature.

To eliminate draining the UPS batteries, the system should remain plugged into the wall outlet with the circuit breaker in the ON position.

5-4-10 Internal Storage Devices:

- Minimum 20 Gigabyte EIDE Hard Disk Drive (HDD) inside the Back End Processor cabinet.
- 5.25 inch Magneto-Optical Drive (MOD) (option) available from front of scanner.
- CD-RW Drive available from front of scanner.

5-4-11 Inputs

5-4-11-1 AC Power

Table 5-2 AC Power

Input	Description	Connection from:
230 VAC	AC Power	AC Distribution Box > Backend Processor

5-4-11-2 DC Voltages

Table 5-3 DC Input Voltages

Input	Description	Connected to:
+5Vstb	Standby voltage	DC Power Supply via Backplane
GND	Electrical Ground	DC Power Supply via Backplane and II/O

5-4-11 Inputs (cont'd)

5-4-11-3 Input Signals

Table 5-4 Input Signals

Signal Name	Description	Signal Path
PWR_OK*	Power verification signal from Card Rack	Card Rack > IIO > PC2IO
ON/OFF Switch	Signal from the ON/OFF switch on the Control Panel and from the Reset button on the rear of the External I/O.	Top Console > IIO > PC2IO ON/OFF Reset (EIO) > IIO > PC2IO
I2C Register Interrupt	Interrupt signal from I2C Bus	EIO > IIO > PC2IO
Microphone in to BEP	Microphone signal from Monitor (Top Console)	Top Console > IIO > BEP
Audio in to BEP	Audio from VCR or Doppler Audio	Replay Audio from VCR > IIO > BEP Doppler Audio Out from Card Rack > IIO > BEP

5-4-11-4 Bi-directional Signals

Table 5-5 Bi-directional Signals

Signal Name	Description	Signal Path
UPS Control RS232	Control Signals to and from the UPS	BEP > IIO
RS232 XDCTRL	Not Used	PC2IO > IIO > Not Used
I2C Bus	Data bus used for Remote Control of External Units and for reading module versions.	PC2IO > IIO > EIO
Spare RS232	Not Used	PC2IO > IIO > Not Used
VCR Remote Ctrl (RS232)	Control signal to Internal VCR	PC2IO > IIO > VCR
USB #1	USB bus to Top Console	PC2IO > IIO > Top Console
COM 1	Not Used	PC2IO > IIO > EIO
COM 2	Modem	PC2IO > IIO > EIO (Rear of Module) > Modem
Ethernet	Standard TCP/IP Ethernet	BEP > IIO > EIO > External Network
USB #2	USB Bus for External Units	BEP > IIO > EIO > External USB Unit

5-4-12 Outputs

Table 5-6 Output Signals

Signal Name	Description	Signal Path
+5VDC	DC Voltage	PC2IO > IIO
+12VDC	DC Voltage	PC2IO > IIO
PS_ON*	Active Low	PC2IO > IIO > Card Rack
Standby		PC2IO > IIO > Top Console
SVideo	SVideo Out	PCVIC > PC2IO > IIO > EIO
CVideo	Composite Color Video	PCVIC > PC2IO > IIO > EIO
VGA	VGA High Resolution Video to External Video Screen	PCVIC > PC2IO > IIO > EIO
VGA	VGA High Resolution Video to Internal Video Screen (Top Console)	BEP > Top Console
BW Video RGB	BW Video from RGB. This signal is not used on Vivid 7 / Vivid 7 PRO	PCVIC > PC2IO > IIO > EIO This signal is not used on Vivid 7 / Vivid 7 PRO
Audio Out	Audio Out from BEP	BEP > IIO > Internal VCR BEP > IIO > EIO > External VCR
TRIG	Video Trig Signal	PC2IO > IIO > EIO

Section 5-5
Patient I/O (Physio)

The Patient I/O is mounted inside the Backend Processor's cabinet with its connector panel available on the front of the scanner.

The Patient IO contains the electronics for ECG, phono and two analog inputs. One of the inputs has programmable gain. The module extracts respiration from ECG. The electronics also contains a pacemaker detector. The four inputs are separately isolated because of safety requirements.

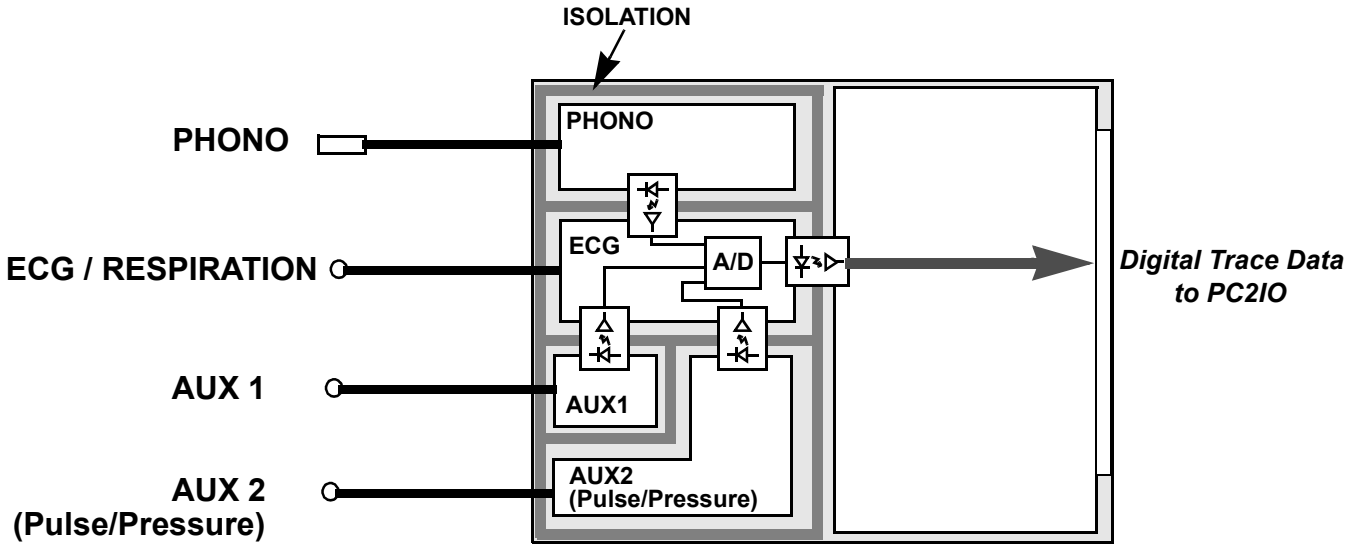


Figure 5-8 Pat I/O - Block Diagram

Available inputs

- Phono (from a phono heart microphone)
- ECG / Respiration
- AUX1
- AUX2 (Pulse/Pressure)

These signals are optically isolated from the rest of the system.

Section 5-6
Internal I/O

The **Internal I/O** is the interface between the Card Cage, BEP Module, and the rest of the system, including the Top Console and the Peripherals.

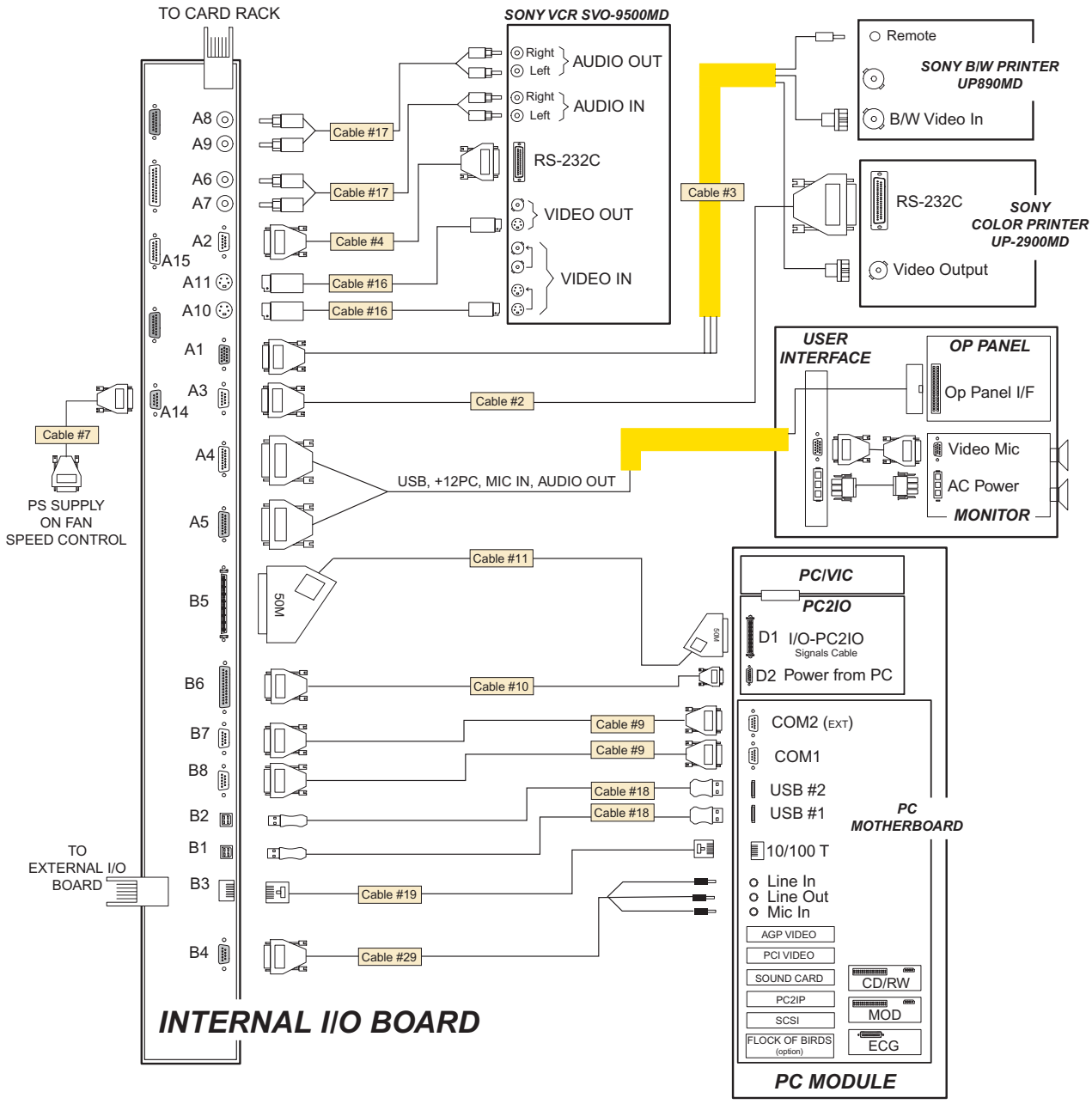


Figure 5-9 Internal I/O Module Overview

Section 5-6 Internal I/O (cont'd)

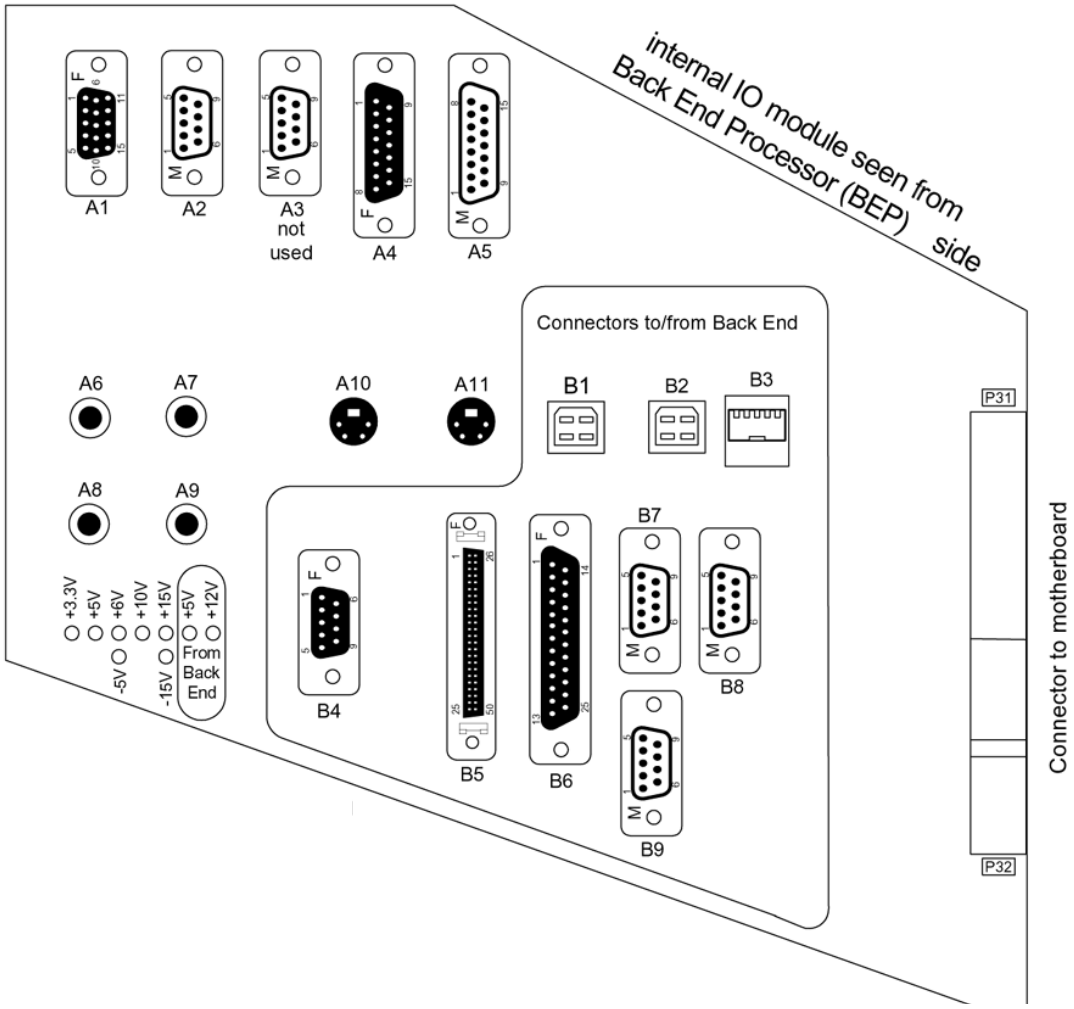


Figure 5-10 Internal I/O Back End Processor Connections

The Internal I/O board performs buffering and distribution of video and control data from various sources to multiple destinations.

- SVGA (R, G, B and Sync.) are fed from the BEP, directly up to the system monitor. Another set of RGB can be fed to a color printer.
- Composite video, black and white video and S-Video are buffered and distributed to VCR and printers.
- The analog Doppler signals are fed from the Spectrum Doppler board to the VCR audio inputs and through a switch where audio from VCR playback also is input, to the BEP and then to the speakers.
- Serial RS-232 interface signals from the BEP are fed to the destinations; VCR, Color Printer and Modem.
- Serial USB interface signals from the BEP are fed to the Front Panel and to EIO.
- Remote control signals for printers are generated on the I/O board.
- The Footswitch is connected to the I/O board.
- An AC Power Interface controls power on/off and fan speed.

5-6-1 Location in the Unit

The Internal I/O Module is plugged into the Card Rack (at the end nearest to the rear of the system).

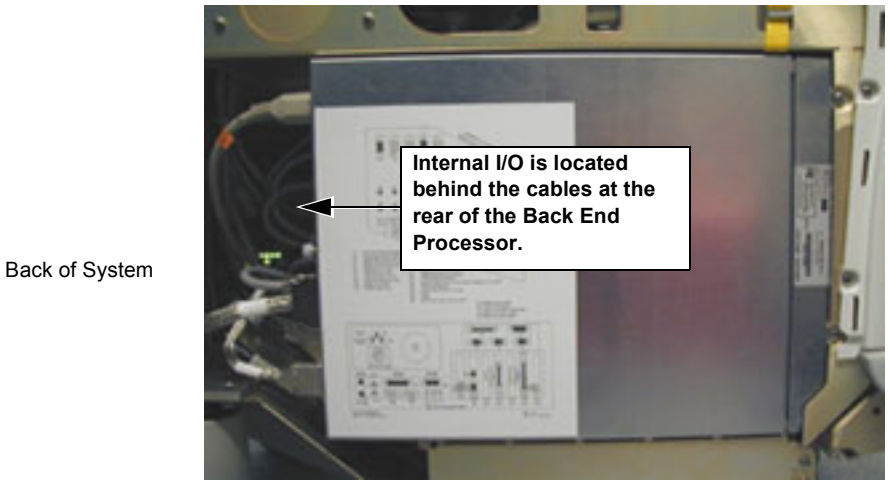


Figure 5-11 Internal I/O: Location in the System (Seen from Left Side)

5-6-2 LEDs

Nine green LEDs indicate that the respective DC Voltages are OK.



Figure 5-12 Internal I/O: Green LEDs for Power Status.

5-6-3 Fuses

All output voltages are fused

5-6-4 Jumpers and Dip-switches

TBD

5-6-5 Inputs

DC Voltages

Table 5-7 DC Input Voltages

Input	Description	Connection from
+3.3 VDC	Input DC Voltage	DC Power Supply > Backplane > J32
+5 VDC	Input DC Voltage	DC Power Supply > Backplane > J32
+10 VDC	Input DC Voltage	DC Power Supply > Backplane > J32
+15 VDC	Input DC Voltage	DC Power Supply > Backplane > J32
-15 VDC	Input DC Voltage	DC Power Supply > Backplane > J32
+6 VDC (analog)	Input DC Voltage	DC Power Supply > Backplane > J32
–5 VDC (analog)	Input DC Voltage	DC Power Supply > Backplane > J32
+5 VDC	Input DC Voltage	Backend Processor > J17
+12 VDC	Input DC Voltage	Backend Processor > J17)

Video Input Signals

Table 5-8 Video Input Signals

Input	Description	Connection from
SVGA	Video Signal to External I/O	PC2IO (Connector J16)
SVHS	Video Signal to VCR & External I/O	PC2IO(Connector J16)
SVHS	Video Signal to MBD (IMP)	VCR (Connector J11)
Luma	Video Signal to B&W Printer and External I/O	PC2IO (Connector J16)
Comp. Video	Video Signal to External I/O	PC2IO (Connector J16)
Comp. Video	Video Signal to MBD (IMP)	Color printer

Audio Input Signals

Table 5-9 Audio Input Signals

Input	Description	Connection from
Two channel audio	Audio signals, summed and distributed	MBD (IMP)
Two channel audio		VCR
Two channel audio		BEP

5-11-13-3 Inputs (cont'd)

Serial Ports

Table 5-10 Serial Ports

Input	Description	Connection from
USB	Standard USB Serial Bus	BEPM - Top console
USB	Standard USB Serial Bus	BEPM - IEIO
Ethernet	Standard Ethernet	BEPM - IEIO
RS232	Standard RS232 Serial Bus	BEPM COM1 - IEIO
RS232	Standard RS232 Serial Bus	BEPM COM2 - IEIO
RS232	Standard RS232 Serial Bus	PC2IO - Spare (J16)
RS232	Standard RS232 Serial Bus	PC2IO - VCR (J16)
RS232		PC2IO - Color printer (Connector J16)
RS232		PC2IO – UPS (Connector J16)

Control Signals

Table 5-11 Control Signals

Input	Description	Connection from
Control signals	Spare	MBD/FEC (Connector J??)
Control signals	Spare	MBD/FEC (Connector J?)
Trace trigger	To EIO	PC2IO (Connector J16)
Fan control signals	To AC Power	MBD (Connector J?)
Power control signals	To MBD and AC Power	PC2IO (Connector J16)
Power on/off	To Relay	Top Console ON/OFF Switch and EIO Test (Connector J?)
Standby	To Top Console	PC2IO (Connector J16)

5-6-6 Outputs

DC Voltage

Table 5-12 DC Output Voltages

Output	Description	Connection to
+5 VDC +12 VDC	From BEP	Spare (Connector J21)
+5 VDC, -15 VDC, -5 VDC $_{analog}$	From Card Rack	
+5 VDC +12 VDC	From BEP	Not Used
+5 VDC, -15 VDC, -5 VDC $_{analog}$	From Card Rack	
+5 VDC, +15 VDC,	From Card Rack	Not Used
+12 VDC	From BEP	Top Console
+15 VDC	From Card Rack	
+5 VDC +12 VDC	From BEP	EIO
+5 VDC, +15 VDC, -5 VDC $_{analog}$ +6 VDC $_{analog}$	From Card Rack	

AUDIO

Table 5-13 Audio Outputs

Output	Description	Connection to
Audio (two channels)	Audio (Doppler sound) from MBD (IMP), VCR, BEP	Top Console speakers and BEP
		VCR and IEIO

5-11-13-4 Outputs (cont'd)

Interface Connectors – Component Side

Table 5-14 Connectors, Component Side

Input	Description	Connection from
A1/J1	B&W printer, 15pins HD-sub, female.	
A2/P4	VCR remote ctrl – RS232: 9pins D-sub, male.	
A3/P5	Color printer - RS232: 9pins D-sub, male.	
A4/J2	Top Console - Power & signals: 15pins D-sub, female.	
A5/P4	Top Console - Signals: 15pins D-sub, male.	
A6/J6	Audio out to VCR, left: Phono jack.	
A7/J7	Audio out to VCR, right: Phono jack.	
A8/J8	Audio in from VCR, left: Phono jack.	
A9/J9	Audio in from VCR, right	
A10/J10	SVHS out to VCR	
A11/J11	SVHS in from VCR	
B1/J12	USB to Top console	
B2/J13	USB to external I/O	
B3/J14	Ethernet	
B4/J15	Audio I/O	
B5/J16	PC2IO signals	
B6/J17	PC2IO power	
B7/P18	COM1	
B8/P19	COM2	
B9/P25	UPS remote control	
J32	MBD – signals and power	

Table 5-15 Connectors, Solder side

Input	Description	Connection from
A12/J21	Spare power, 15pins D-sub, female	
A13/J20	Spare – power, 15pins D-sub, female	
A14/J24	AC power ctrl, 9pins D-sub, female	
A15/P23	Rotation adapter – signals, 15pins D-sub, male	
A16/P22	Spare – signals, 25pins D-sub, female	
P30	EIO – signals and power, 110pins male	

Section 5-7
Top Console

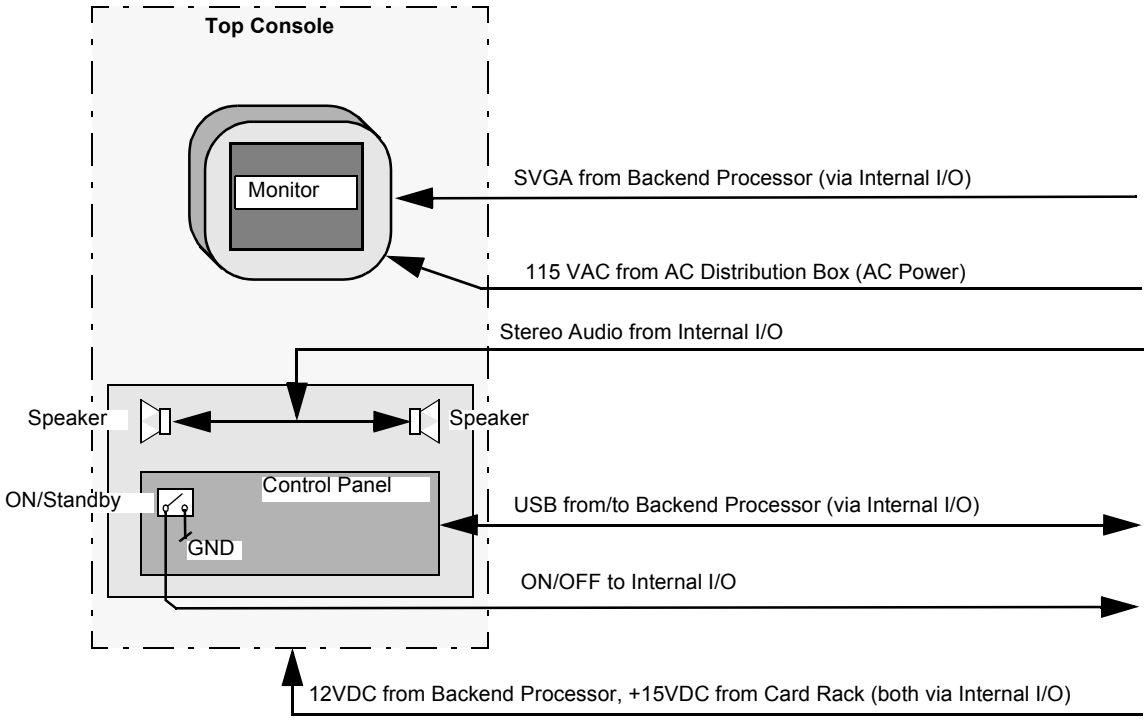

Top Console
Monitor
SVGA from Backend Processor (via Internal I/O)
115 VAC from AC Distribution Box (AC Power)
Stereo Audio from Internal I/O
Speaker
Speaker
Control Panel
ON/Standby
GND
USB from/to Backend Processor (via Internal I/O)
ON/OFF to Internal I/O
12VDC from Backend Processor, +15VDC from Card Rack (both via Internal I/O)

Figure 5-13 Top Console Block Diagram

The Top Console includes;

- a SVGA video monitor
- a Control Panel with;
  - an ON/OFF (standby) switch
  - an alphanumeric (QWERTY) keyboard
  - controls for manipulating the picture quality and for use in Measure & Analyze (M&A)
- speakers for stereo sound output (used during Doppler scanning/replay)

Section 5-8
Peripherals

5-8-1 On-board Peripherals

(*See "Approved On-board Peripherals" on page 3-32.*)

- VCR (connected to Internal I/O)
- Black & White Video Printer (connected to Internal I/O)
- Color Video Printer (connected to BEP - D5)
- Modem (connected to External I/O)

5-8-2 External Peripherals

(*See "Off-board Peripherals" on page 3-32.*)

- Color Inkjet Printer
- Footswitch, Phone Line and Ethernet are connected to External I/O

Section 5-9
Modem

The modem is intended for an analog phone line. It is used for InSite/iLink communication with the Online Center.

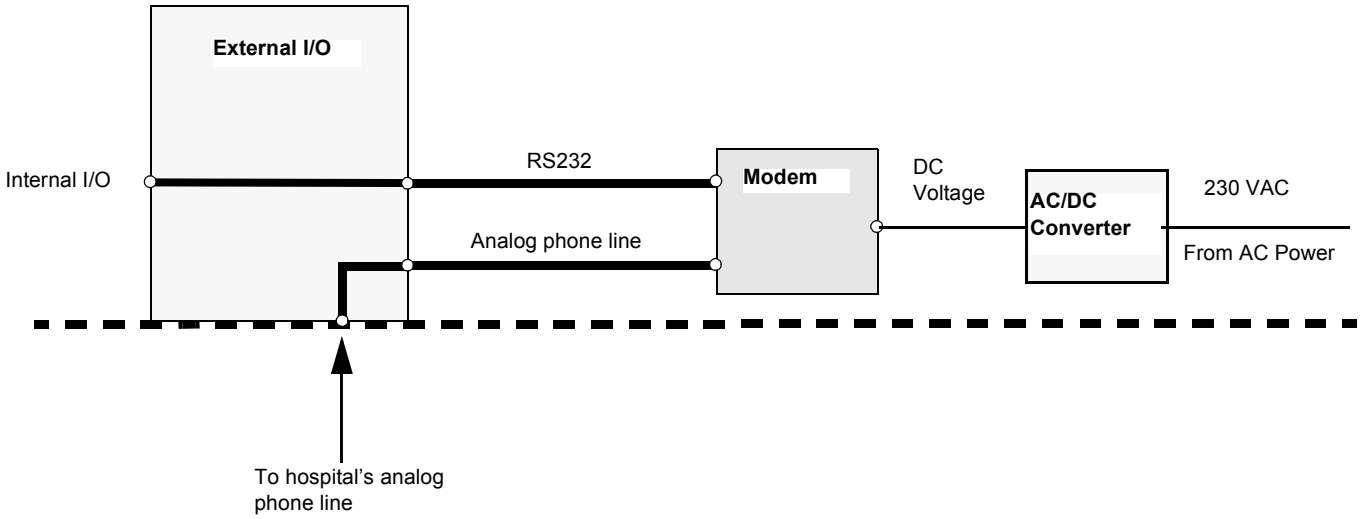


Figure 5-14 Modem Block Diagram

Section 5-10
Power Distribution

5-10-1 Overall AC Power Distribution

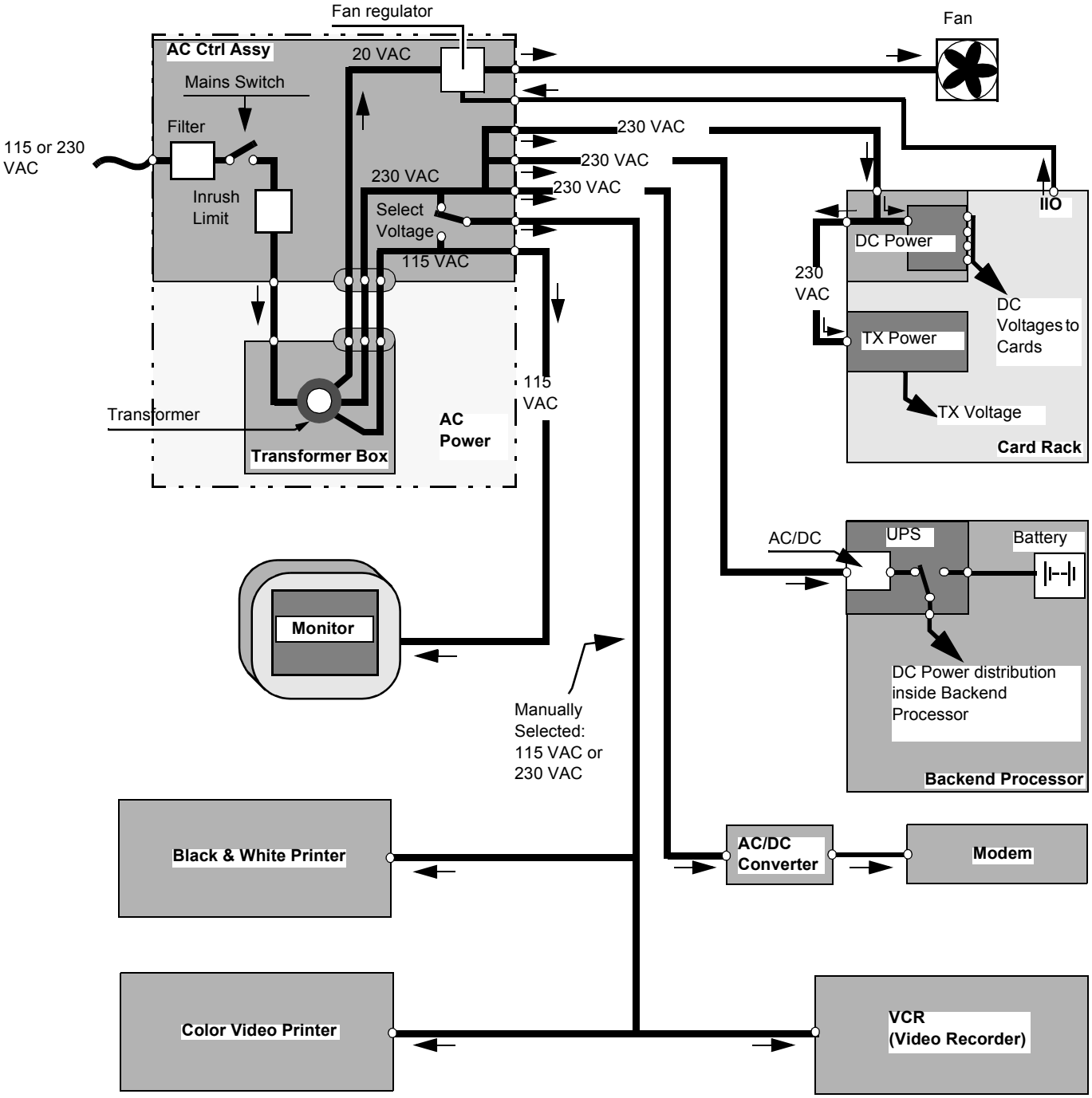


Figure 5-15 Overall Power Distribution

5-10-2 Overview

The AC Power's main tasks are to supply the various internal subsystems with AC power and to galvanically isolate the scanner from the on site Mains Power System. To reduce inrush current, an inrush current limiter as well as an EMI filter. Voltage to peripherals can be configured to either 115 VAC or 230 VAC. The AC Power also controls and supplies the 20VAC needed by the systems cooling fan.

5-10-3 AC Power Distribution Box (PWB)

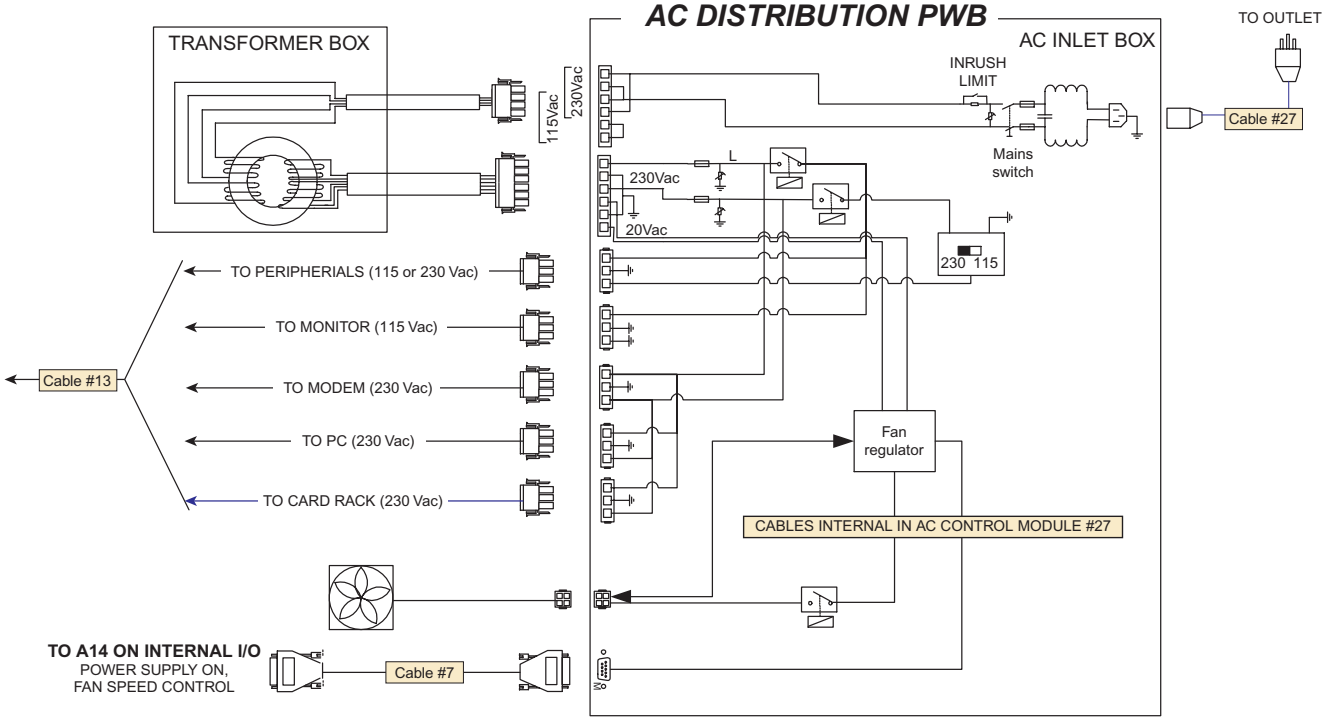


Figure 5-16 AC Power Distribution

The mains cord has plugs in both ends. A female plug connects to the scanner and a male plug to the mains outlet on site.

The mains voltage is routed via an EMI filter to the Mains Switch, located on the rear of the system.

The Mains Switch is of the auto fuse type, if for some reason the current grows to high, the switch will automatically break the power.

From the Mains Switch, the AC power is routed via an Inrush Current Limiter (titled: Inrush Limiter in Figure 5-16) to a internal outlet connector for the Mains Transformer.

5-10-3 AC Power Distribution Box (PWB) (cont'd)

The Transformer is the galvanic barrier between the rest of the scanner and the on site AC Mains.

Input voltage to the transformer can be either 230VAC or 115 VAC (two different part numbers/FRUs). The configuration of the plug on the cable to the AC Transformer is different for the two AC Voltages.

From the AC Transformer, there are three outlets;

- 20 VAC
- 115 VAC
- 230 VAC

The 20 VAC is routed via the fan regulator to the system fan.

The 115 VAC is routed via a fuse to an AC Voltage selector, used for selecting the right output voltage for the Peripherals outlet and the Monitor. (The alternative voltage to this outlet is 230 VAC.)

The 230 VAC output from the Transformer is routed via a fuse and distributed to the AC Voltage selector for the Peripherals outlet and to the following AC outlets:

- Modem
- Back End Processor
- Card Rack

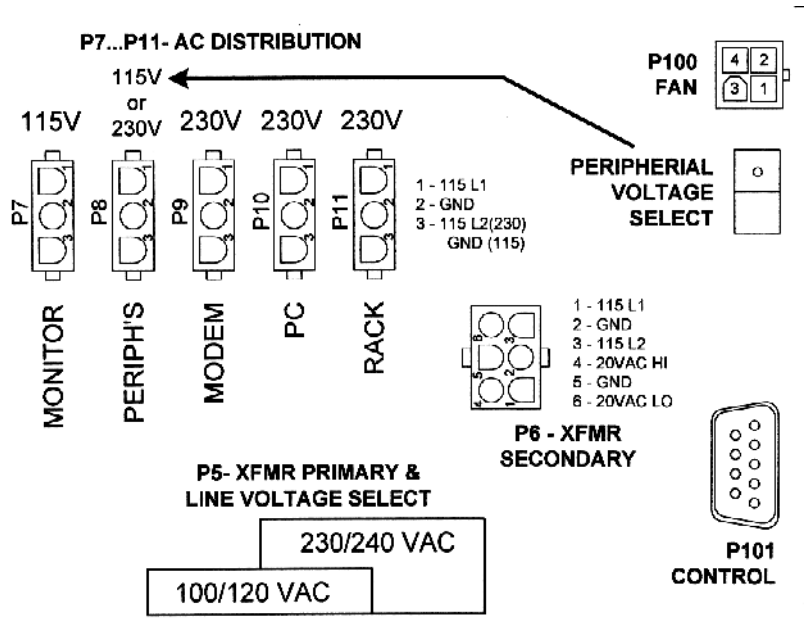


Figure 5-17 Connectors on Back of AC Controller

5-10-4 DC Power

5-10-4-1 General Description

- The DC Power module is a switch mode power supply, enclosed in a metal frame that slides into the Card Rack.
- The module connects to the Mother Board (Backplane) through two F48 pin male connectors and supplies DC voltage via the Backplane, to all the boards in the Card Rack, and to I/O and Front Panel.

5-10-4-2 Location in the Unit

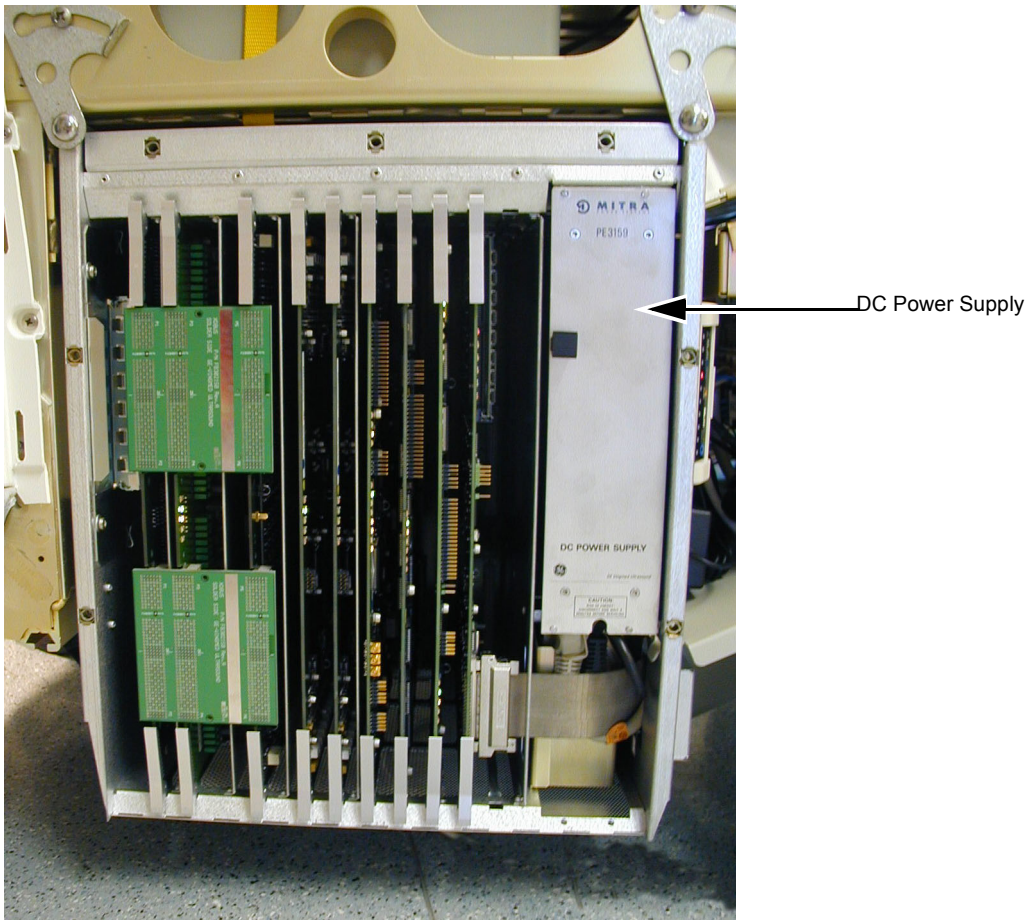


Figure 5-18 DC Power: Location in the Unit

5-10-4-3 Inputs

AC Voltage. Plug P1, 230 VAC

Table 5-16 Input, Plug P1, 230 VAC

Input	Description	Connection from:
230 VAC	AC Input via a three pin male (IEC) mains inlet	Cable from the AC Power Distribution Box

5-10-4-3 Inputs (cont'd)

Sense and Control Signals, Plug P3/4

Table 5-17 Sense and Control Signals, Plug P3/4

Input/Output	Description	Connection from/to:
+ 3.3 Sense	Remote sense	+3.3 V from Motherboard
- 3.3 Sense	Remote sense	-3.3 V from Motherboard
PS_ON*	Active low control signal used to turn the DC Power ON. Controls the AC Power output to TX Power.	From: ON/OFF (Standby) key on Front Panel?
SYNC.	Not used	FEC
PWR_OK	Control signal. Is high when the DC voltages are within specification. Is low when power is on its way ON or OFF. Used for control of AC Power output to TX Power.	

5-10-4-4 Outputs

AC Voltage Output, Plug P2

Table 5-18 AC Voltage Output, Plug P2, 230VAC

Output	Description	Connected to
230 VAC	AC output via a three pin female (IEC) mains plug on cable. This power is output enabled by use of a relay. It is controlled by PS_ON* (active low) and PWR_OK (high)	TX Power

5-10-4-4 Outputs (cont'd)

DC Output Voltages, Plug P3/P4

Table 5-19 DC Output Voltages, Plug P3 & P4

Output	Description	Connected to:
+ 3.3 V	DC output voltages, distributed via Mother Board (Back Plane)	BF64 (two boards)
+ 5 Vd	DC output voltage, distributed via Mother Board (Back Plane). The "d" indicates that this voltage is used for digital circuits.	BF64 (two boards) FEC RFT SDP IMP2 Front Panel I/O
+ 6 Va	DC output voltage, distributed via Mother Board (Back Plane). The "a" indicates that this voltage is used for analog circuits	Relay TX RX
- 5 Va	DC output voltage, distributed via Mother Board (Back Plane). The "a" indicates that this voltage is used for analog circuits.	Relay RX BF64 (two boards) FEC RFT SDP IMP2
+5Vstb	Standby voltage	TBD
+10 V	DC output voltage, distributed via Mother Board (Back Plane)	TX
+15 V	DC output voltage, distributed via Mother Board (Back Plane)	Relay RX Front Panel I/O
- 15 V	DC output voltage, distributed via Mother Board (Back Plane)	RX Front Panel I/O
GND	Distributed via Mother Board (Back Plane)	All boards

5-10-4-5 Fuses

- None.
- A current limiter will switch off the power if + 3.3 V, +5 V or +15 V outputs are overloaded
- Over Voltage Protection is provided for these voltages:
  - + 3.3 V
  - + 5 Vd
  - +/- 5 Va
  - +/- 15 Va
- Voltage will be turned off if the temperature grows too high.

5-10-4-6 Jumpers and Dip-switches

None.

5-10-4-7 LEDs

None.

(Observe the LEDs on Internal I/O to check DC Voltage Status, see "Internal I/O" on page 5-79.)

5-10-5 TX Power Supply

5-10-5-1 General Description

The TX Power is a switch mode power supply module. It is used to generate two symmetrical pairs of digitally programmable voltages for the transmitters in the Vivid 7 / Vivid 7 PRO scanner, and a fixed +/- 100VDC Probe MUX Voltage used by the multiplexers in Linear Array Probes with more than 128 transducer elements.

- It is enclosed in a metal frame that slides into the Card Rack.
- The module connects to the Mother Board (Backplane) through a 32 pin connector
- A pin between the two upper mounting holes, fits into the a corresponding hole in the Card Rack. This key is used to prevent it from being plugged into other scanners.

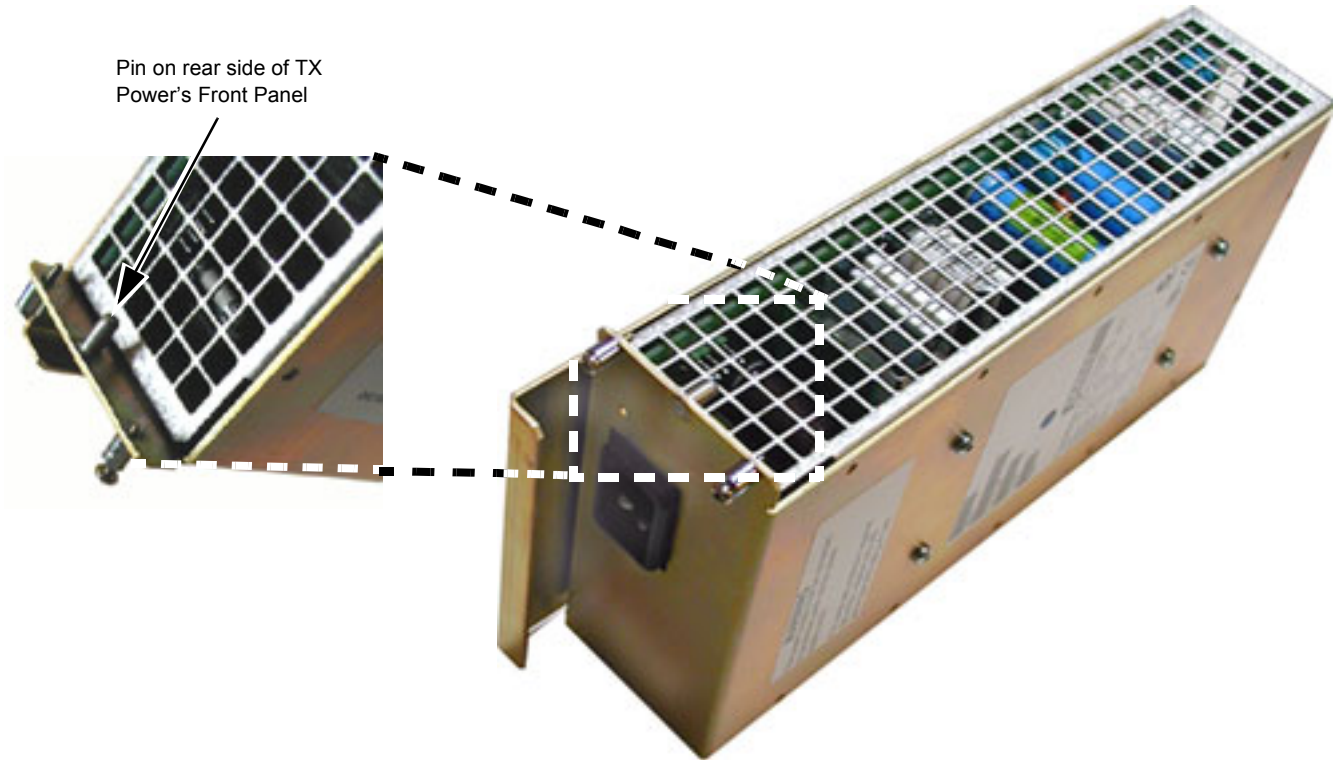


Figure 5-19 TX Power Supply: Front Panel with Key (Pin)

5-10-5-2 Location in the Unit

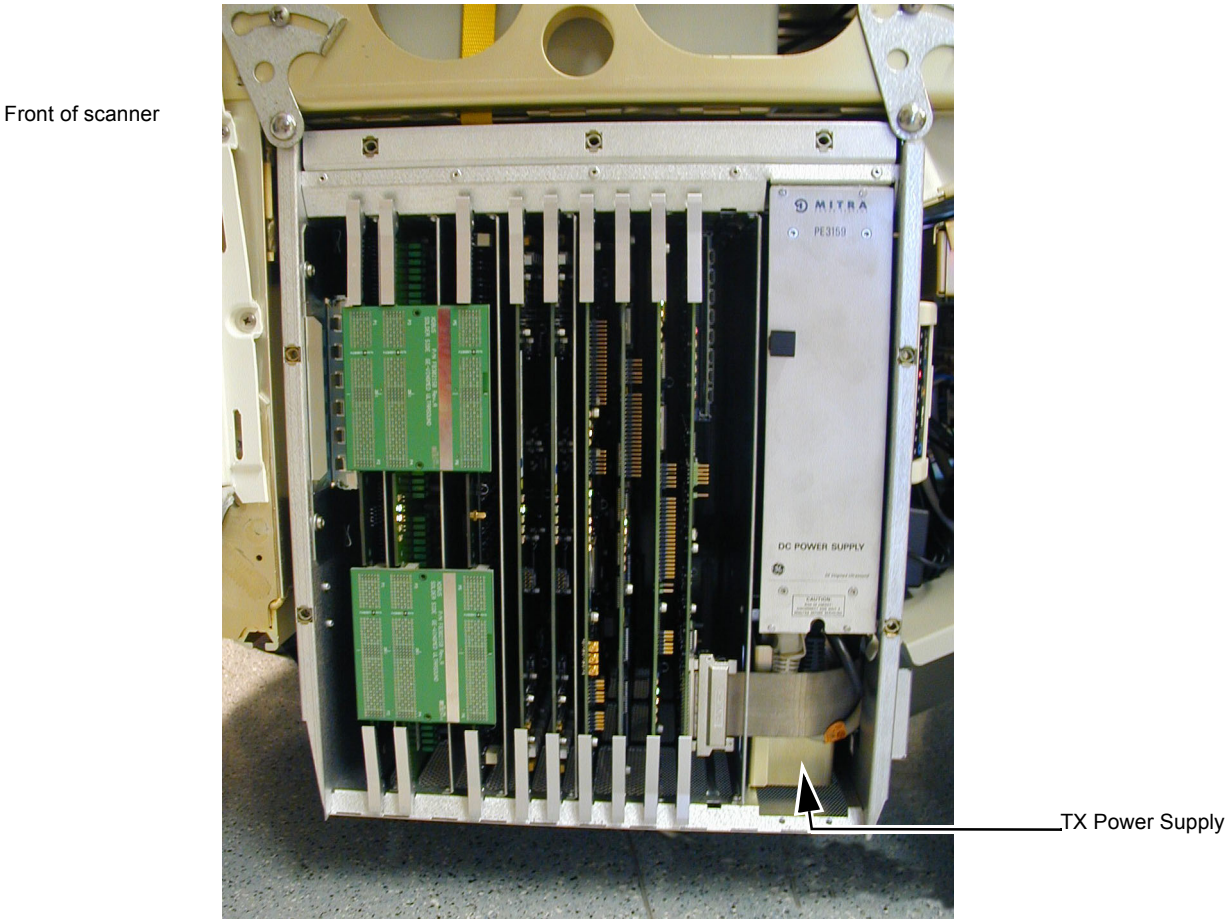


Figure 5-20 TX Power Supply: Location in the Unit (below the DC Power Supply)

5-10-5-3 Inputs

AC Voltage. Plug P1, 230 VAC

Table 5-20 Input, Plug P1, 230 VAC

Input	Description	Connection from:
230 VAC	AC Input via a three pin male (IEC) mains inlet	Cable from the DC Power Module

5-10-5-4 Outputs

Output Voltages, Plug P2

Table 5-21 Output Voltages, Plug P2

Output	Description	Connected to:
TSV1	TX Voltage 1 Voltage can be programmed to vary from +/- 2.5 V to +/- 80V Used to drive the transmitters in 2D Mode and M mode	TX board
TSV2	TX voltage 2 Voltage can be programmed to vary from +/- 2,5 V to +/- 40V Used to drive the transmitters in Doppler (CW/PW) mode and in Color Flow Mapping (CFM) mode	TX board
PMXVOUT	Probe Multiplexing Voltage A fixed +/-100 V Voltage Used for the multiplexers in linear array probes with more than 128 transducer elements	RLY board

5-10-5-5 Fuses

- Output Power Protection Circuit with these functions:
  - Protect probe and TX board if a failure make the voltage exceed limits
  - Protect the power supply if there is a failure in probe or transmitter circuit
- A watch-dog disables the voltage (set it to zero Volt) if the;
  - serial communication with the FEC-2 module stops
  - nominal Power limit is exceeded
  - maximum Power limit is exceeded

5-10-5-6 Jumpers and Dip-switches

None.

5-10-5-7 LEDs

None.

Section 5-11
Circuit Boards

5-11-1 Overview

This section describes the Circuit Boards in Vivid 7 / Vivid 7 PRO.

Table 5-22 Contents in Section 5-11

Sub-section	Description	Page Number
5-11-2	Relay Board, RLY	5-45
5-11-3	Transmitter Board, TX128	5-47
5-11-4	Receiver Board, RX-128	5-50
5-11-5	Beamformer Board(s), BF-64	5-53
5-11-6	Front End Controller Board, FEC-2	5-56
5-11-7	Transducer Bus Boards, XD BUS Boards	5-61
5-11-8	RF & Tissue Processor Board, RFT	5-62
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5-11-10	Image Port 2 Board, IMP2	5-70
5-11-11	Backend Processor	5-74
5-11-12	Patient I/O	5-78
5-11-13	Internal I/O	5-79
5-11-14	External I/O	5-87
5-11-15	Interconnect Cabling	5-90
5-11-16	Motherboard (Back Plane)	5-92
5-11-17	Modem	5-93

5-11-2 Relay Board, RLY

5-11-2-1 General Description

The Relay Board has three PA probe connectors, a “blind” PA slot used to park a fourth probe and a connector for a stand alone Doppler probe containing two transducer elements.

- In receiving mode, the Relay Board connects the transducer channels from the selected probe to the RX-128 and TX-128 boards via the XDBUS.
- The Relay Board routes the TX power supplies to the active probe.
- It also routes the Probe Multiplexer Control Signal to the active probe.

5-11-2-2 Location in the Unit

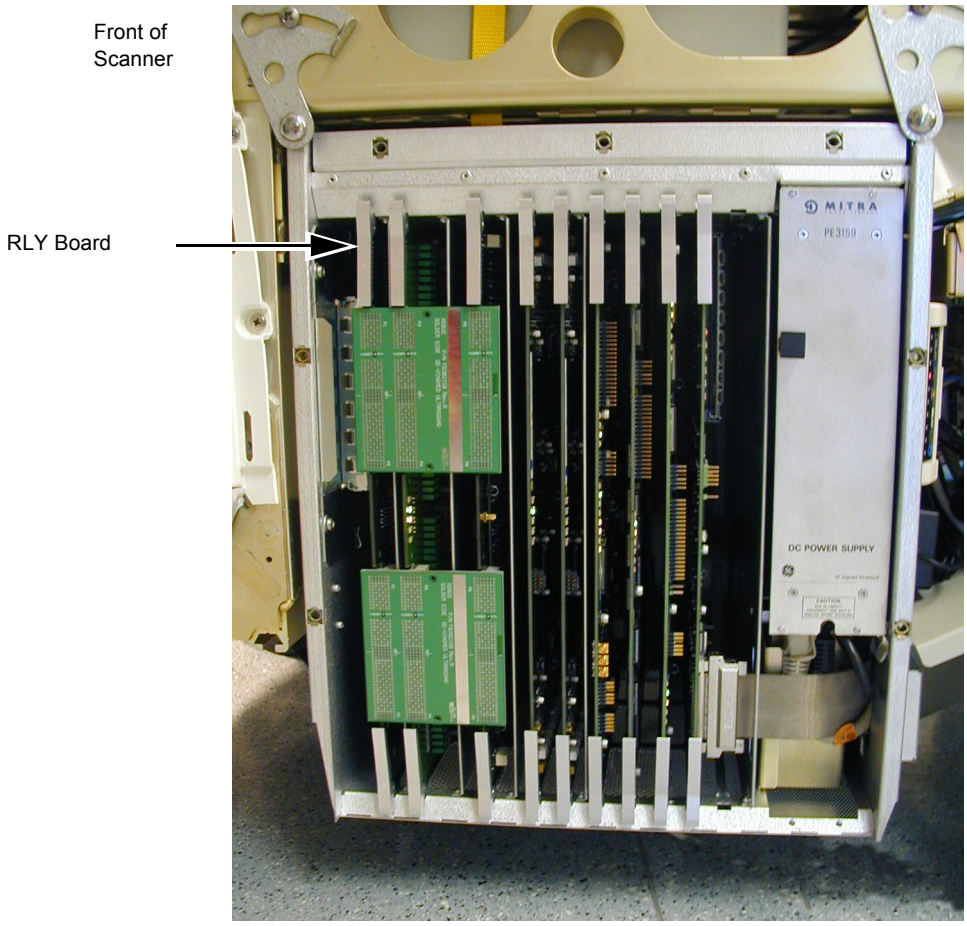


Figure 5-21 RLY Board: Location in Unit

5-11-2-3 Inputs

DC Voltages

Table 5-23 DC Output Voltages, Plug P3 & P4

Input	Description	Connected from:
+ 5 Va	DC output voltage, distributed via Mother Board (Back Plane). The “a” indicates that this voltage is used for analog circuits	DC Power Supply > Backplane
- 5 Va	DC output voltage, distributed via Mother Board (Back Plane). The “a” indicates that this voltage is used for analog circuits.	DC Power Supply > Backplane
GND	Distributed via Mother Board (Back Plane)	DC Power Supply > Back Plane

Input Signals

Table 5-24 Input Signals

Input	Description	Connection from:
EL1-128	Received signals (echoes) and Transmitted pulses (1 of 3 probe connectors)	The active probe

Control Signals

Table 5-25 Input Signals

Input	Description	Connection from:
Front End Data Bus	Digital data bus used for control of the boards in the Front End	RLY > Backplane > FEC
Probe MUX Control	Probe Configuration	RLY > Backplane > FEC

5-11-2-4 Outputs

Output Signals

Table 5-26 Output Signals

Output	Description	Connection to:
XD1 - 128	128 signals to TX-128 and RX-128	XD Bus Boards
CW or PW TX	CW or PW Doppler transmitter pulses	Stand Alone Doppler probe
CW or PW RX	CW or PW Doppler RX signals (echoes)	Stand Alone Doppler probe

5-11-2-5 Fuses, Jumpers and Dip-switches

None

5-11-2-6 LEDs

None.

5-11-3 Transmitter Board, TX128

5-11-3-1 General Description

The Transmitter Board (TX128) contains 128 individually controlled transmit channels and provides transmit pulses to the transducer array (the probes).

Outputs

The outputs from the TX128 board are the 128 transmitters channels XD1-128. They are fed from the P4 and P5 connectors via the XD Bus Boards to the Relay Board and then to the selected PA connector.

5-11-3-2 Location in the Unit

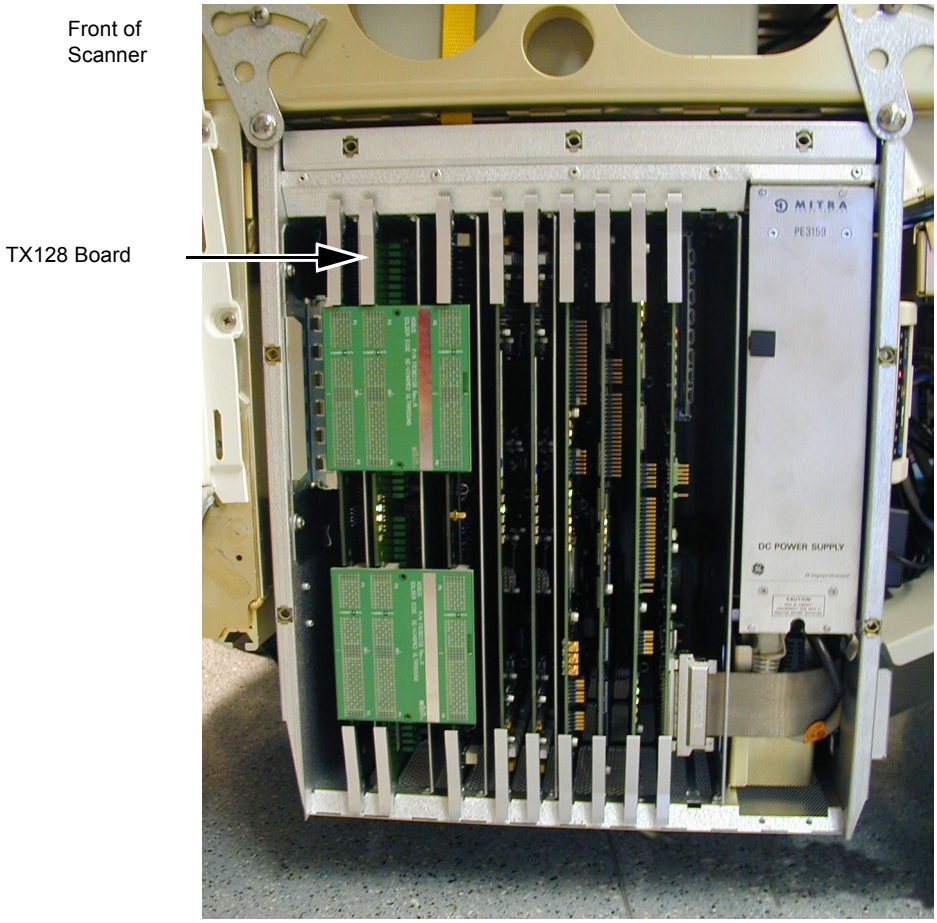


Figure 5-22 TX128 Board: Location in Unit

5-11-3-3 Inputs

DC Voltages

Table 5-27 Input, DC Voltages

Input	Description	Connection from:
+5 Va	DC voltage, distributed via Mother Board (Back Plane). The “a” indicates that this voltage is used for analog circuits.	DC Power
+10 V	DC voltage, distributed via Mother Board (Back Plane). The + 10V is only used by this board.	DC Power
GND	Ground is distributed via Mother Board (Back Plane).	DC Power
TSV1	TX Voltage 1 Voltage can be programmed to vary from +/- 2.5 V to +/- 80V Used to drive the transmitters in 2D Mode and M Mode	TX Power Supply > Backplane
TSV2	TX voltage 2 Voltage can be programmed to vary from +/- 2,5 V to +/- 40V Used to drive the transmitters in Doppler (CW/PW) mode and in Color Flow Mapping (CFM) mode	TX Power Supply > Backplane

Control Signals

Table 5-28 Input, Control Signals

Input	Description	Connection from:
FE_D0-15	Front End Data bus, Digital TTL	Front End Controller > Back Plane
FE_PA0-9	Front End Page Address bus, Digital TTL	Front End Controller > Back Plane
FE_SA0-5	Front End Device Select Address bus, Digital TTL	Front End Controller > Back Plane
TX_TRIG_L	Transmit trigger, Digital TTL	Front End Controller > Back Plane

5-11-3-4 Outputs

Table 5-29 Output TX pulses, Plug P4 & P5

Output	Description	Connected to:
XD1 - 128	128 transmitter channels via the connectors P4 and P5 to the XD Bus Board	TX128 > XD Bus Board > Relay Board

5-11-3-5 Fuses, Jumpers and Dip-switches

None

5-11-3-6 LEDs

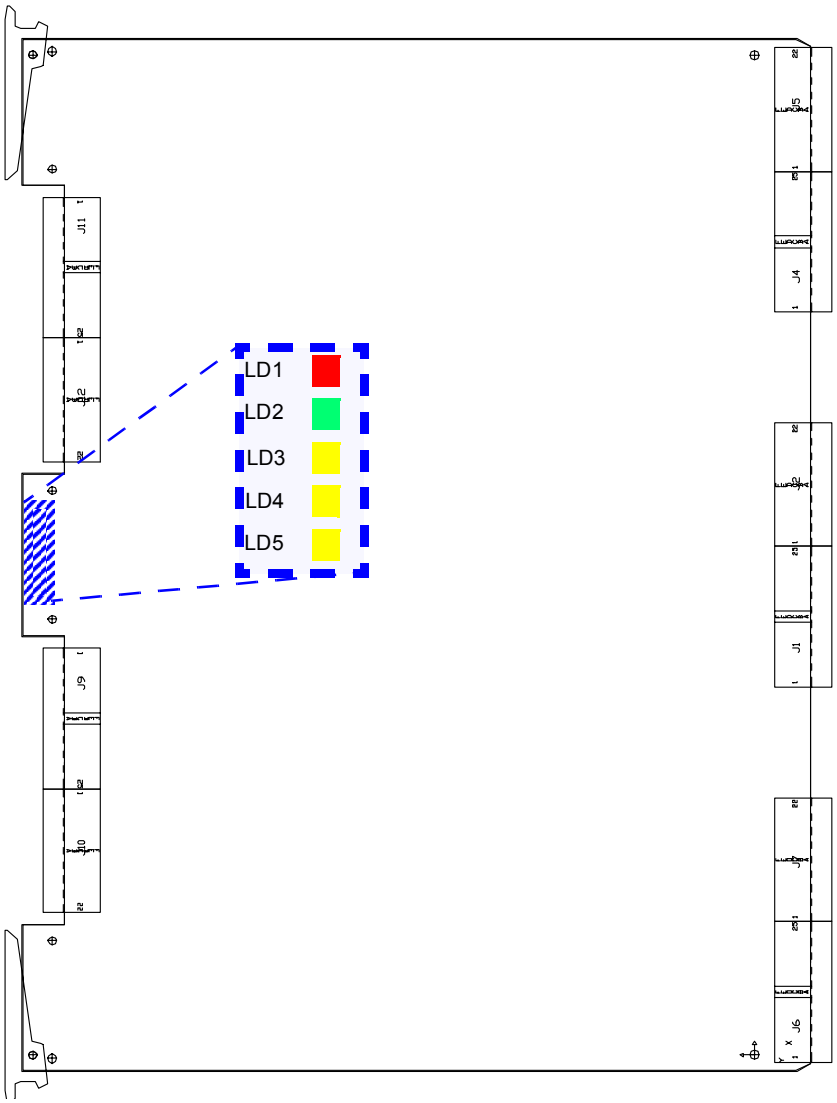


Figure 5-23 TX128 Board: LEDs

Table 5-30 LEDs on the TX128 Board

LED #	LED Color	Description	Normally State
LD1	- Red	Board Failure	Normally OFF
LD2	- Green	Board OK	Normally ON
LD3	- Yellow	Front End Bus Protocol Error	Normally OFF
LD4	- Yellow	Scan	Normally OFF
LD5	- Yellow	Spare	Normally OFF

5-11-4 Receiver Board, RX-128

5-11-4-1 General Description

The RX-128 Board has 128 identical receive channels.

The signal in each channel is fed via a Transmit/Receive (T/R) switch to a preamplifier. The next step is a Time Controlled Gain (TGC) amplifier used to equalize the signal strength from the near field, the mid field and the far field.

5-11-4-2 Location in the Unit

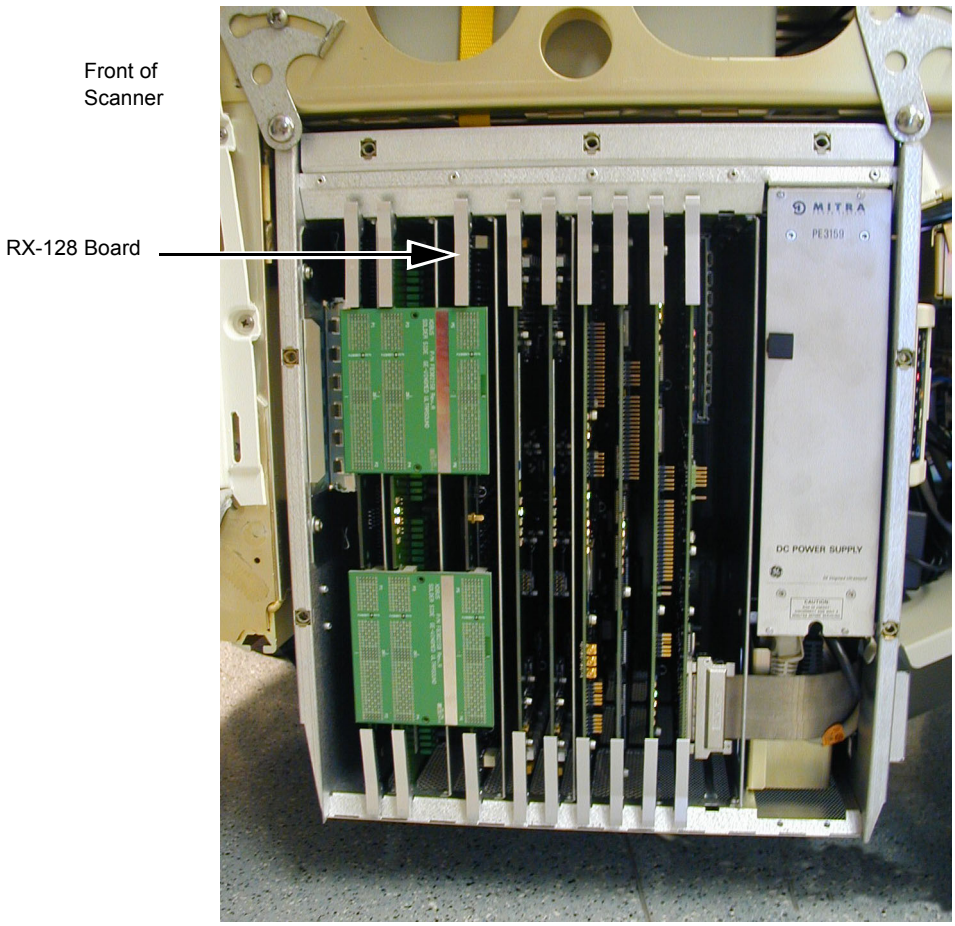


Figure 5-24 TX128 Board: Location in Unit

5-11-4-3 Inputs

DC Voltages

Table 5-31 DC Input Voltages, Plug P3 & P4

Input	Description	Connected to:
+ 5 Va	DC output voltage, distributed via Mother Board (Back Plane). The “a” indicates that this voltage is used for analog circuits	DC Power Supply via Backplane
- 5 Va	DC output voltage, distributed via Mother Board (Back Plane). The “a” indicates that this voltage is used for analog circuits.	DC Power Supply via Backplane
+15 V	DC output voltage, distributed via Mother Board (Back Plane)	DC Power Supply via Backplane
- 15 V	DC output voltages, distributed via Mother Board (Back Plane)	DC Power Supply via Backplane
GND	Distributed via Mother Board (Back Plane)	DC Power Supply via Backplane

Input Signals

Table 5-32 Input Signals

Input	Description	Connection from:
XD1 - XD128	Signals containing the received back-scattered echoes from the active probe.	Relay Board via the XD Bus Boards
Test SIG	Analog test signal	FEC Board
ATGCVP/ATGCVN	TGC Control Voltages	FEC Board

5-11-4-4 Outputs

Output Signals

Table 5-33 Output Signals

Output	Description	Connection to:
RX1 - RX128	128 RX signals (echoes)	Beamformer Boards via Backplane

5-11-4-5 Fuses

None

5-11-4-6 Jumpers and Dip-switches

None

5-11-4-7 LEDs

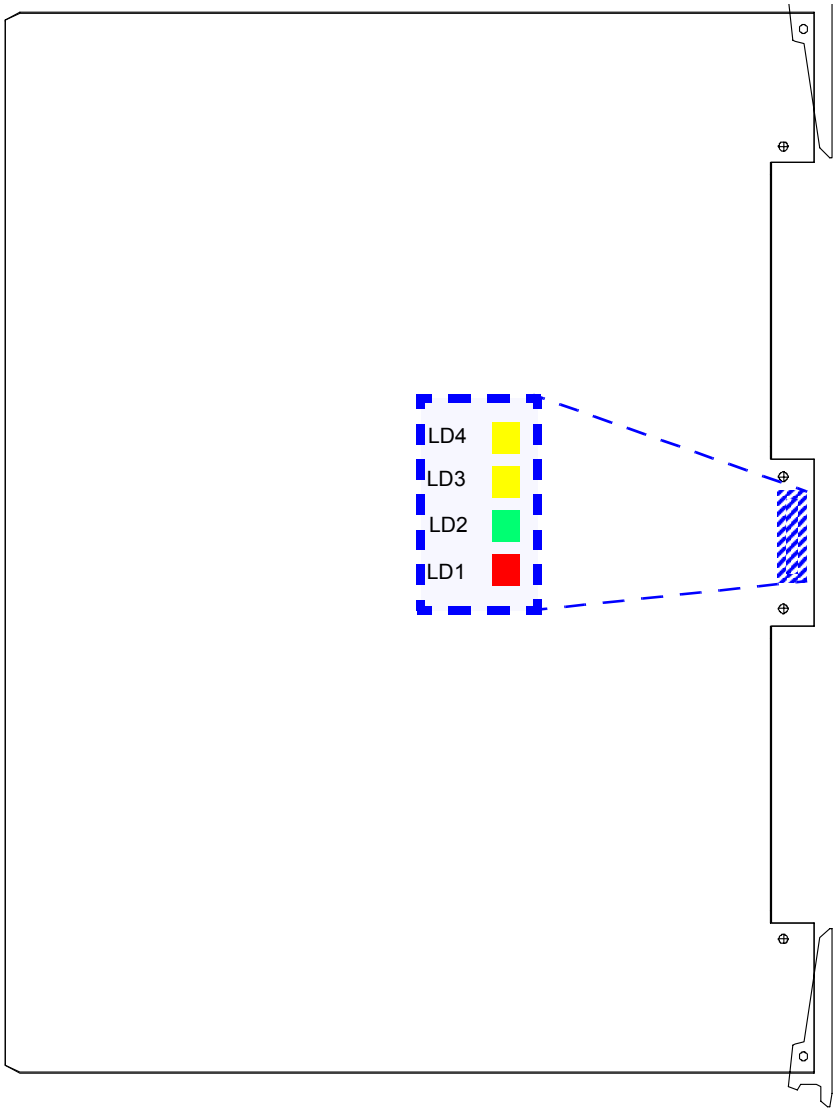


Figure 5-25 RX-128: LEDs (on the Solder Side of the Board)

Table 5-34 RX-128: LEDs (on the Solder Side of the Board)

LED #	LED Color	Description	Normally State
LD1	- Red	Board Failure	Normally OFF
LD2	- Green	Board OK	Normally ON
LD3	- Yellow	Spare	Normally OFF
LD4	- Yellow	Spare	Normally OFF

5-11-5 Beamformer Board(s), BF-64

5-11-5-1 General Description

- The Beam Former Boards convert the analog signals from the RX-128 board to digital form, and performs receive focusing and steering by digital signal delays.
- Each BF-64 board can handle 64 channels, so two boards are used to handle the 128 channels from the RX-128 board.
- The output from the first board is fed to board #2 and summed with the signal on board #2, so the output from board #2 contains the data from all the 128 channels.

5-11-5-2 Location in the Unit

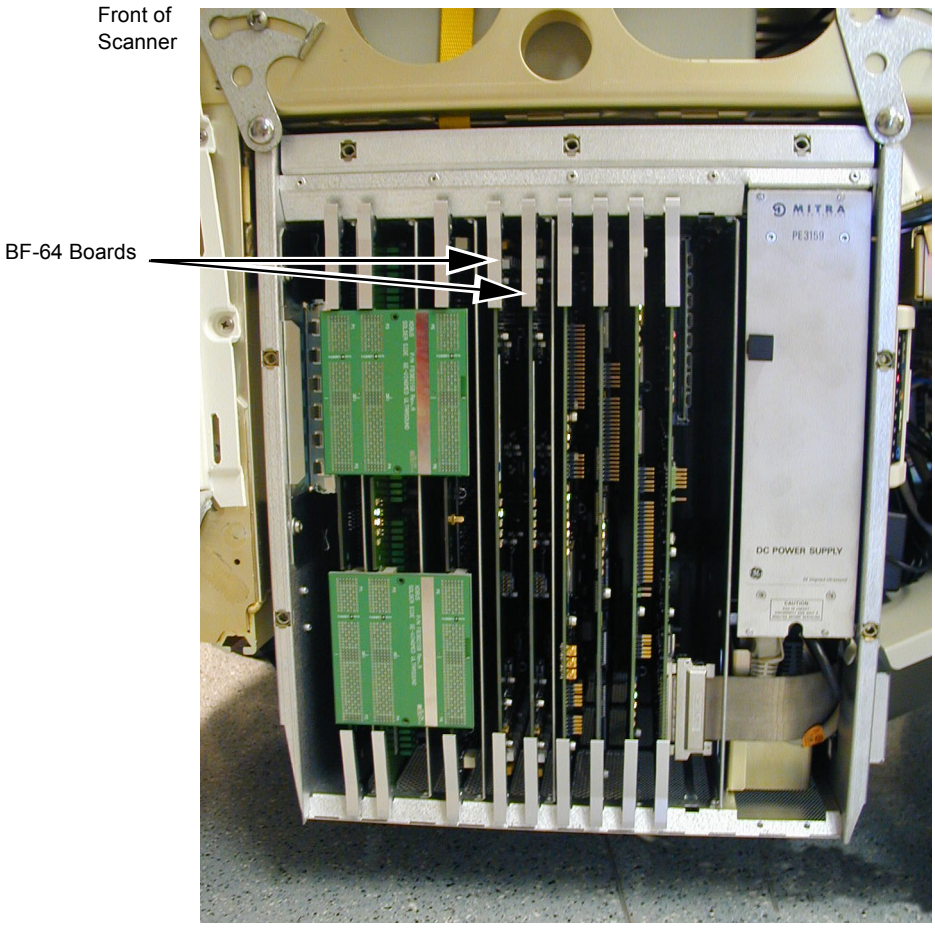


Figure 5-26 BF-64 Boards: Location in Unit

5-11-5-3 Inputs

DC Voltages

Table 5-35 DC Output Voltages, Plug P3 & P4

Input	Description	Connected to:
+ 3.3 V	DC voltage, distributed via Mother Board (Backplane)	DC Power Supply via Backplane
+ 5 Vd	DC output voltage, distributed via Mother Board (Back Plane). The “d” indicates that this voltage is used for digital circuits.	DC Power Supply via Backplane
- 5 Va	DC output voltage, distributed via Mother Board (Back Plane). The “a” indicates that this voltage is used for analog circuits.	DC Power Supply via Backplane
GND	Distributed via Mother Board (Back Plane)	DC Power Supply via Backplane

Input Signals

Table 5-36 Input Signals

Input	Description	Connection from:
RX1 - RX128	Receiver signals	RX-128 board
FE Bus	Front End Bus	FEC Board
MLA0 and MLA1	This input is used on BF64 #2: The output signal from previous board.	BF64 Board #1

5-11-5-4 Outputs

Output Signals

Table 5-37 Output Signals

Output	Description	Connection to:
MLA0 and MLA1	This is the digital output from the board.	From BF64 #1: To BF64 #2. From BF64 #2: To RFT

5-11-5-5 Fuses

None.

5-11-5-6 Dip-switches

None.

5-11-5-7 LEDs and Jumpers

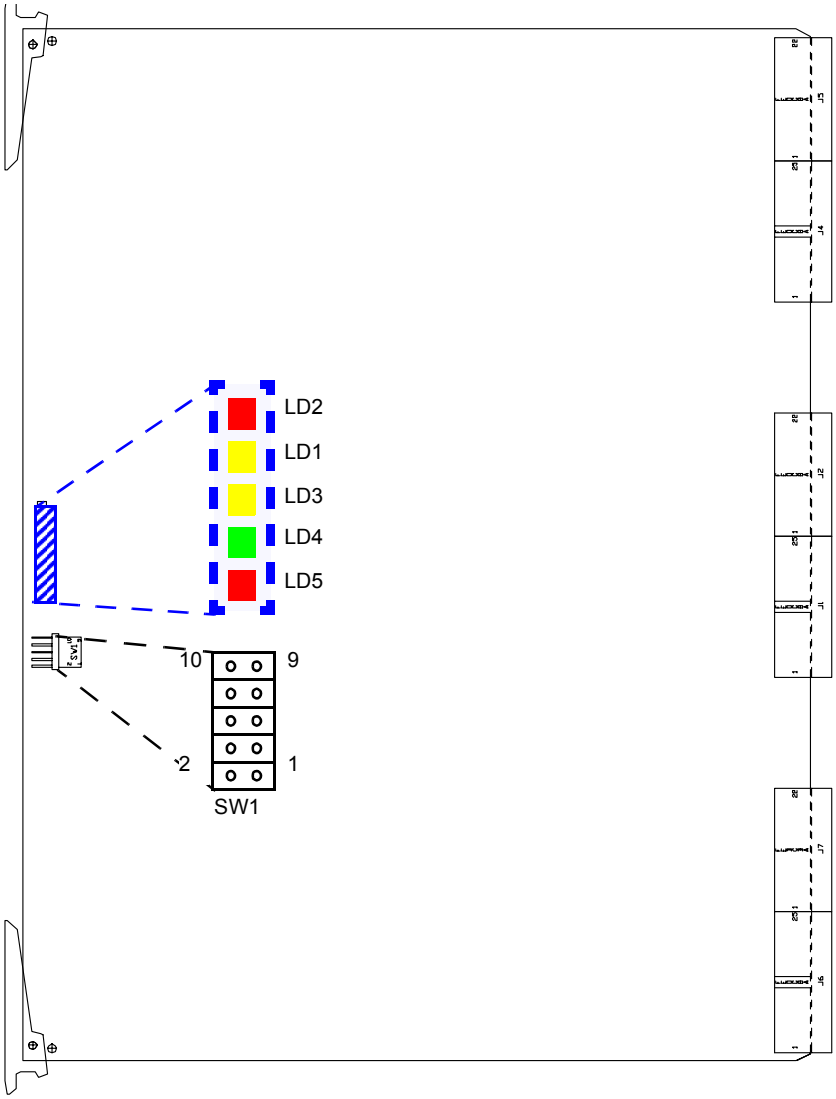


Figure 5-27 BF64: LEDs and Jumpers

Table 5-38 LEDs on the BF-64 Boards

LED Color	Description	Normally State
- Red	Board Failure	Normally OFF
- Green	Board OK	Normally ON
- Yellow	Not Used	Normally OFF
- Yellow	Not Used	Normally OFF
- Red	Supply Voltage Error	Normally OFF

5-11-6 Front End Controller Board, FEC-2

5-11-6-1 General Description

The Front End Controller Board controls the other boards in the Front End. Most of the control is done through the Frond End Bus.

Main tasks done by the board:

- System Master Clock generator
- Transmitter Control
- ATGC Control
- Receive Focusing Control
- Analog Test Signal Generator
- High Voltage Control and supervision
- Probe Sensing
- Control of Relay Board
- Temperature Sensing for TEE probes
- Step Motor Control for TEE probes
- Temperature Sensing for circulated air

5-11-6-2 Location in the Unit

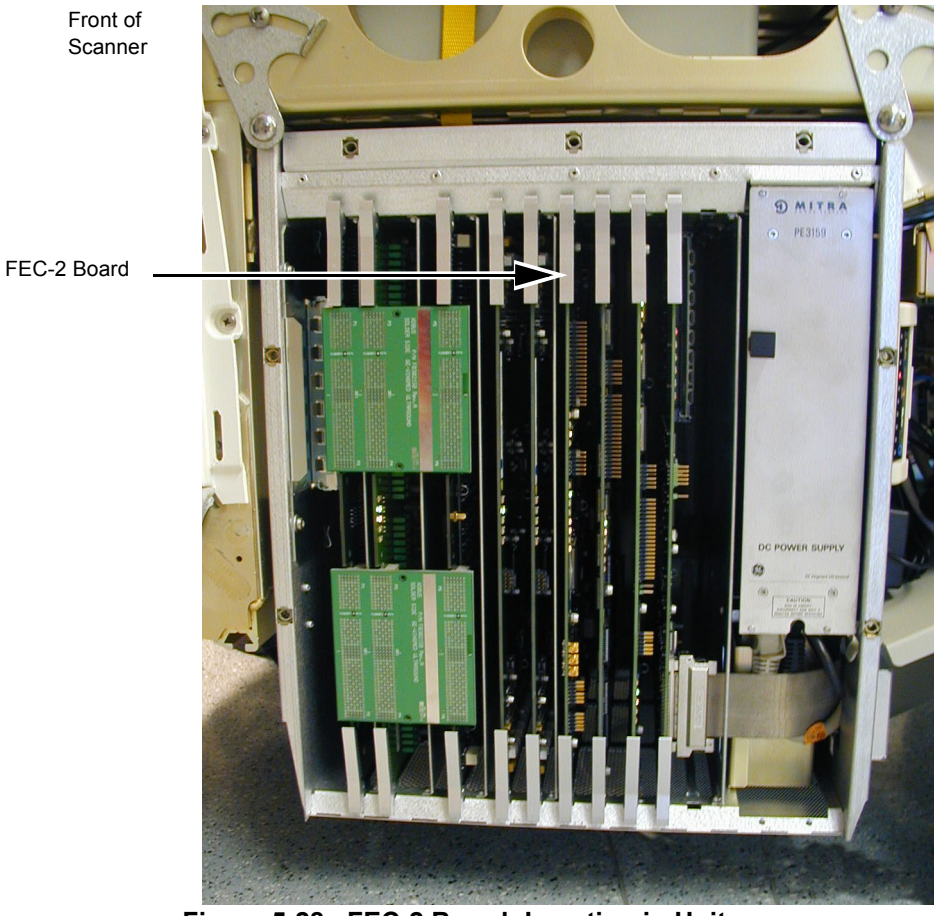


Figure 5-28 FEC-2 Board: Location in Unit

5-11-6-3 Inputs

DC Voltages

Table 5-39 DC Input Voltages

Input	Description	Connected to:
+ 3.3 Vd	DC output voltage, distributed via Mother Board (Back Plane). The “d” indicates that this voltage is used for digital circuits.	DC Power Supply via Backplane
+ 5 Vd	DC output voltage, distributed via Mother Board (Back Plane). The “d” indicates that this voltage is used for digital circuits.	DC Power Supply via Backplane
- 5 Va	DC output voltage, distributed via Mother Board (Back Plane). The “a” indicates that this voltage is used for analog circuits.	DC Power Supply via Backplane
+ 15 Va	DC output voltage, distributed via Mother Board (Back Plane). The “a” indicates that this voltage is used for analog circuits.	DC Power Supply via Backplane
- 15 Va	DC output voltage, distributed via Mother Board (Back Plane). The “a” indicates that this voltage is used for analog circuits.	DC Power Supply via Backplane
GND	Distributed via Mother Board (Back Plane)	DC Power Supply via Backplane

Signal Inputs

Table 5-40 Signal Inputs

Input	Description	Connection from:
PRPRES	Probe Present	Relay Board
High Voltage V & I Sense	Indicates the voltages and currents from the TX Supply	TX Power
VME Bus	Used for communication with the rest of the system (not the Front End Boards). Commands and data from the VME Bus can be routed via the Front End bus to the other boards in the Front End.	The Backend Processor

5-11-6-4 Output

Output Signals

Table 5-41 Output Signals

Output	Description	Connection to:
TXTRIG_L	Starts the transmitter sequence	TX128 boards
SYNC_L	Signal used to synchronize the Beam Formers	BF64 boards
TSIG	Test Signal	RX-128 Board
ATGCVP/ATGCVN	Differential signals used to control TGC on the RX Board	RX-128 Board
TX Voltage Control	One serial data line and several select lines to the TX Supply	TX Supply

5-11-6-5 LEDs Description, Main Digital Signal Processor (DSP)

Table 5-42 FEC-2, Lower Batch of LEDs, Main DSP

LED #	LED Color	Description	Normally State
LD1	- Red	Board Failure	Normally OFF
LD2	- Green	Board OK	Normally ON
LD3	- Yellow	System in scanning mode	ON when scanning OFF in Freeze
LD4	- Yellow	Probe Change	ON during probe change
LD5	- Yellow	No-Probe	OFF if no-probe has been selected
LD6	- Yellow	TX Overrange	OFF. ON if excessive TX Voltage is output Blinking, surveillance period
LD7	- Yellow	VME Access	ON when communicating with BEP.
LD8	- Yellow	DSP Running	BLINKING (1 Hz) “heartbeat”

5-11-6-6 LEDs Description, Slave DSP

Table 5-43 FEC-2, Upper Batch of LEDs, Slave DSP

LED #	LED Color	Description	Normally State
LD27	- Yellow	Rack temperature surveillance	Blinking
LD28	- Yellow	TX Power surveillance	Blinking
LD29	- Green	Up and running	ON Blinking
LD30	- Ref	Failure or reprogramming	OFF

5-11-6-7 FEC-2, LEDs

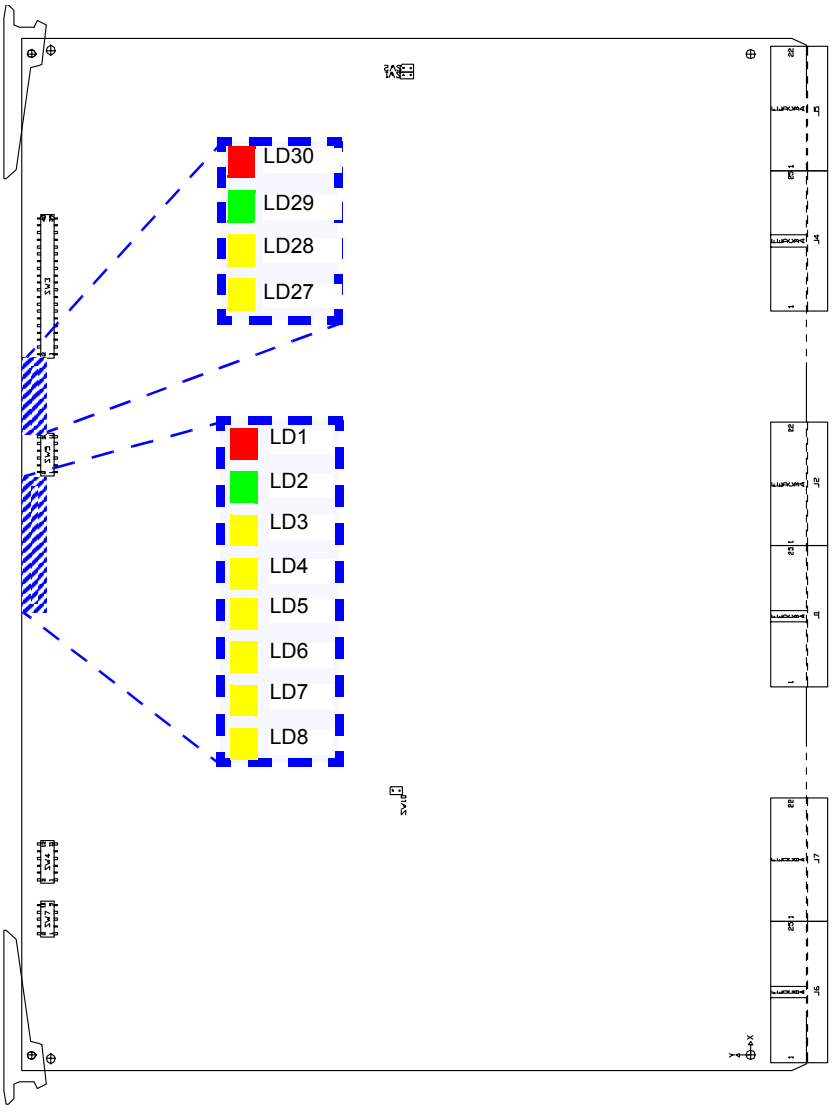


Figure 5-29 FEC-2, LEDs

5-11-6-8 Fuses and Dip-switches

None

5-11-6-9 Jumpers

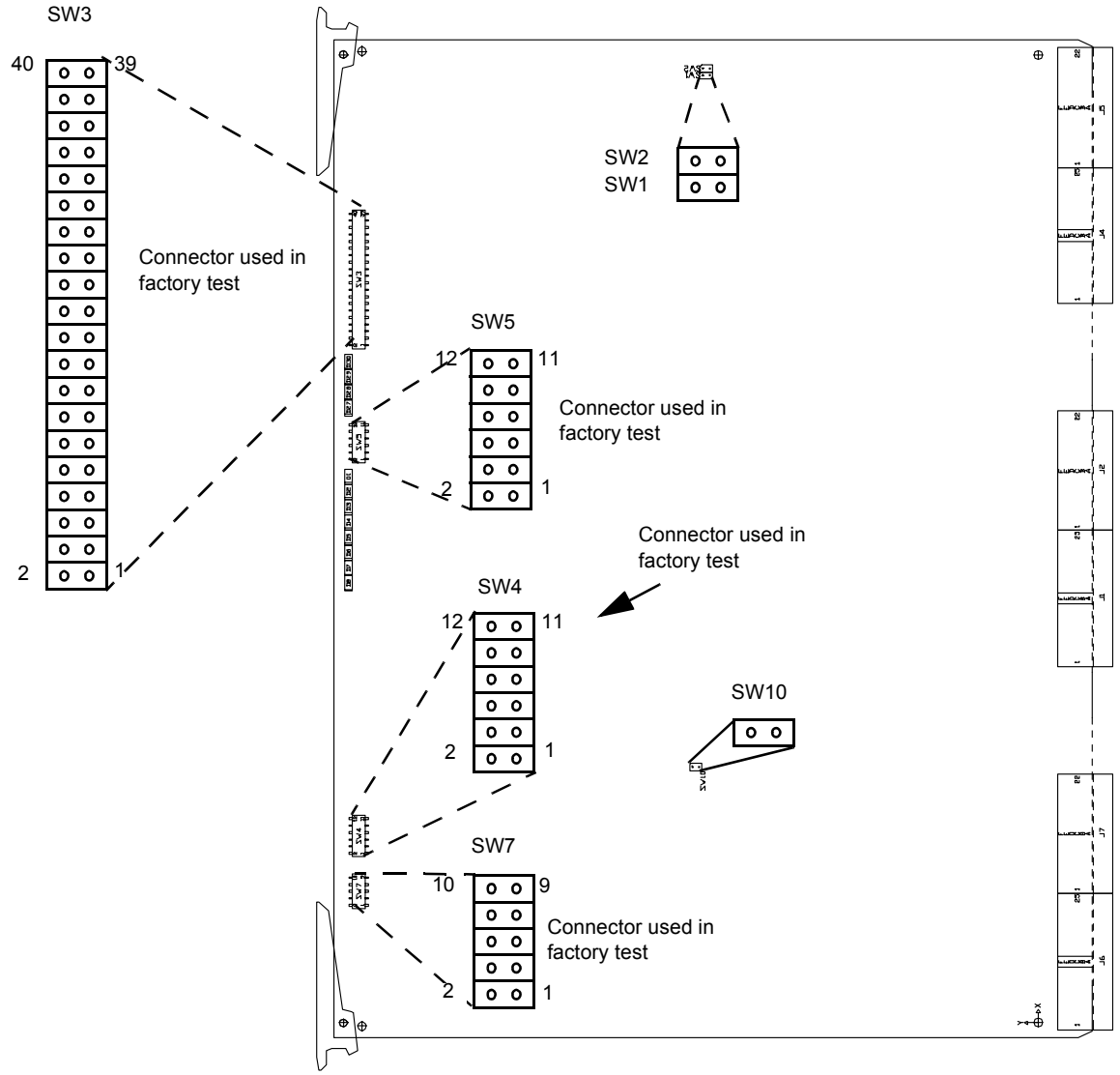


Figure 5-30 FEC-2, Jumpers and Connectors

5-11-7 Transducer Bus Boards, XD BUS Boards

5-11-7-1 General Description

The two XD BUS Boards plugs into the rear edge connectors on the Relay Board, the TX128 Boars and on the RX-128 Board.

The XD signals to and from the probes (via the Relay Board) are routed via this board.

5-11-7-2 Location in the Unit

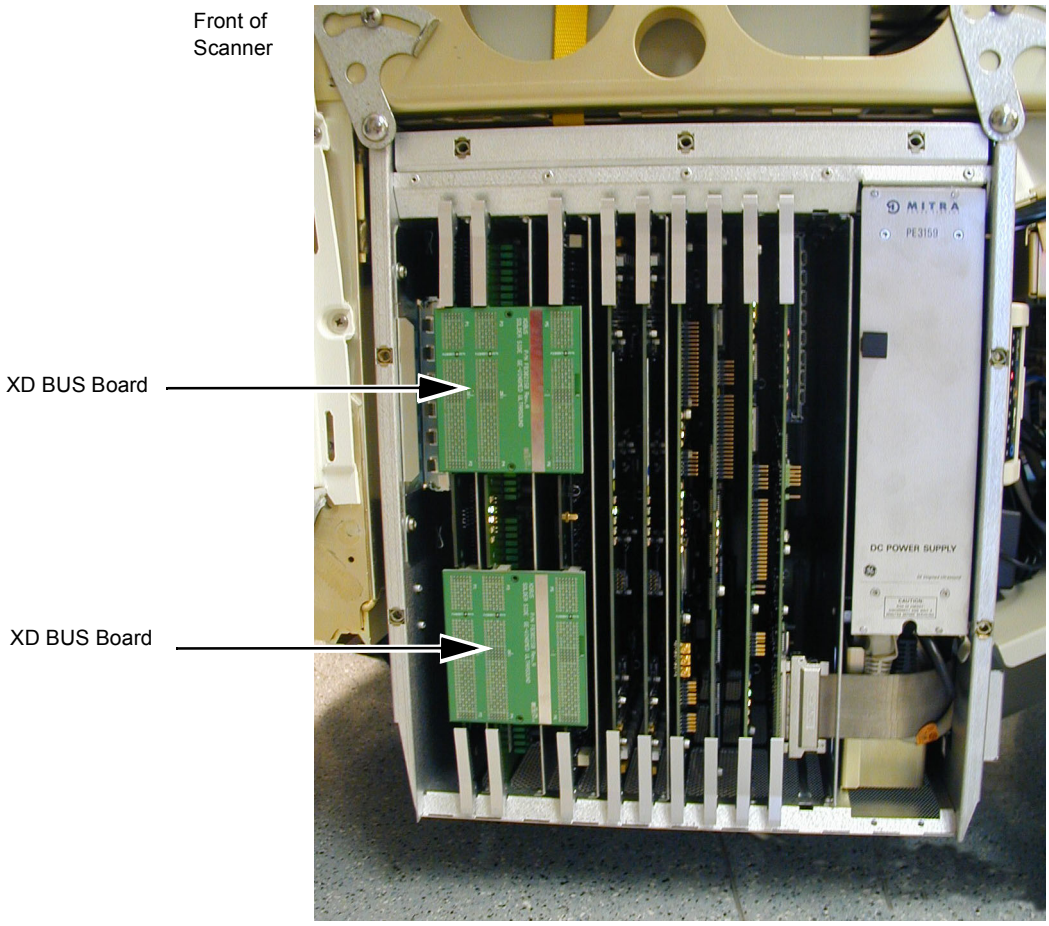


Figure 5-31 XD BUS Boards: Location in Unit

5-11-7-3 Inputs

Input Signals

Table 5-44 Input Signals

Input	Description	Connection from:
XD1 - XD128	Back scattered echo signals (Receive Mode) and Transmitter pulses (Transmit Mode)	Active Probe via Relay board in Receive Mode TX128 in Transmit Mode.

5-11-7-4 Outputs

Output Signals

Table 5-45 Output Signals

Output	Description	Connection to:
XD1 - XD128	Transmitter pulses (Transmit Mode) and Back scattered echo signals (Receive Mode)	Active Probe via Relay board in Transmit Mode RX-128 in Receive Mode.

5-11-7-5 Fuses, Jumpers, Dip-switches and LEDs

None

5-11-8 RF & Tissue Processor Board, RFT

5-11-8-1 General Description

The RFT board extracts Tissue Data, Spectrum Data and IQ & Color Data from the digital data stream on its input. It also performs different types of Tissue Processing.

5-11-8-2 Location in the Unit

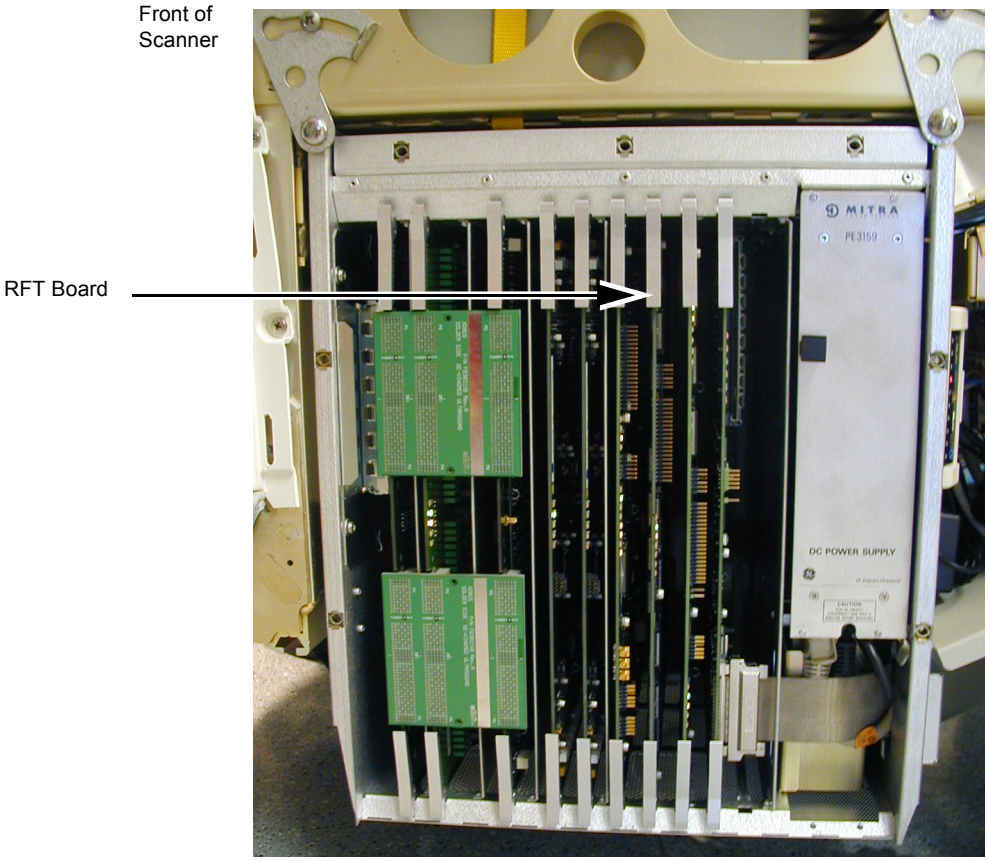


Figure 5-32 RFT Board: Location in Unit

5-11-8-3 Inputs

DC Voltages

Table 5-46 DC Input Voltages

Input	Description	Connection from:
+ 5 Vd	DC output voltage, distributed via Mother Board (Back Plane). The “d” indicates that this voltage is used for digital circuits.	DC Power Supply via Backplane
- 5 Va	DC output voltage, distributed via Mother Board (Back Plane). The “a” indicates that this voltage is used for analog circuits.	DC Power Supply via Backplane
GND	Distributed via Mother Board (Back Plane)	DC Power Supply via Backplane

Input Signals

Table 5-47 Input Signals

Input	Description	Connection from:
MLA 0 & MLA 1	Input data stream	
VME Bus	Data communication	BEP
Front End Bus	Information about the type of data and the data sample.	FEC

5-11-8-4 Outputs

Output Signals

Table 5-48 Output Signals

Output	Description	Connection to:
Clock distribution	Clock distribution	
Pipelink	Digital Data Transfer	BEP, SDP and IMP
P4	Production Test Plug	
P5	Production Test Plug	
VME Bus	Data communication	BEP (via P1)

5-11-8-5 Fuses and Dip-switches

None

5-11-8-6 LEDs and Jumpers

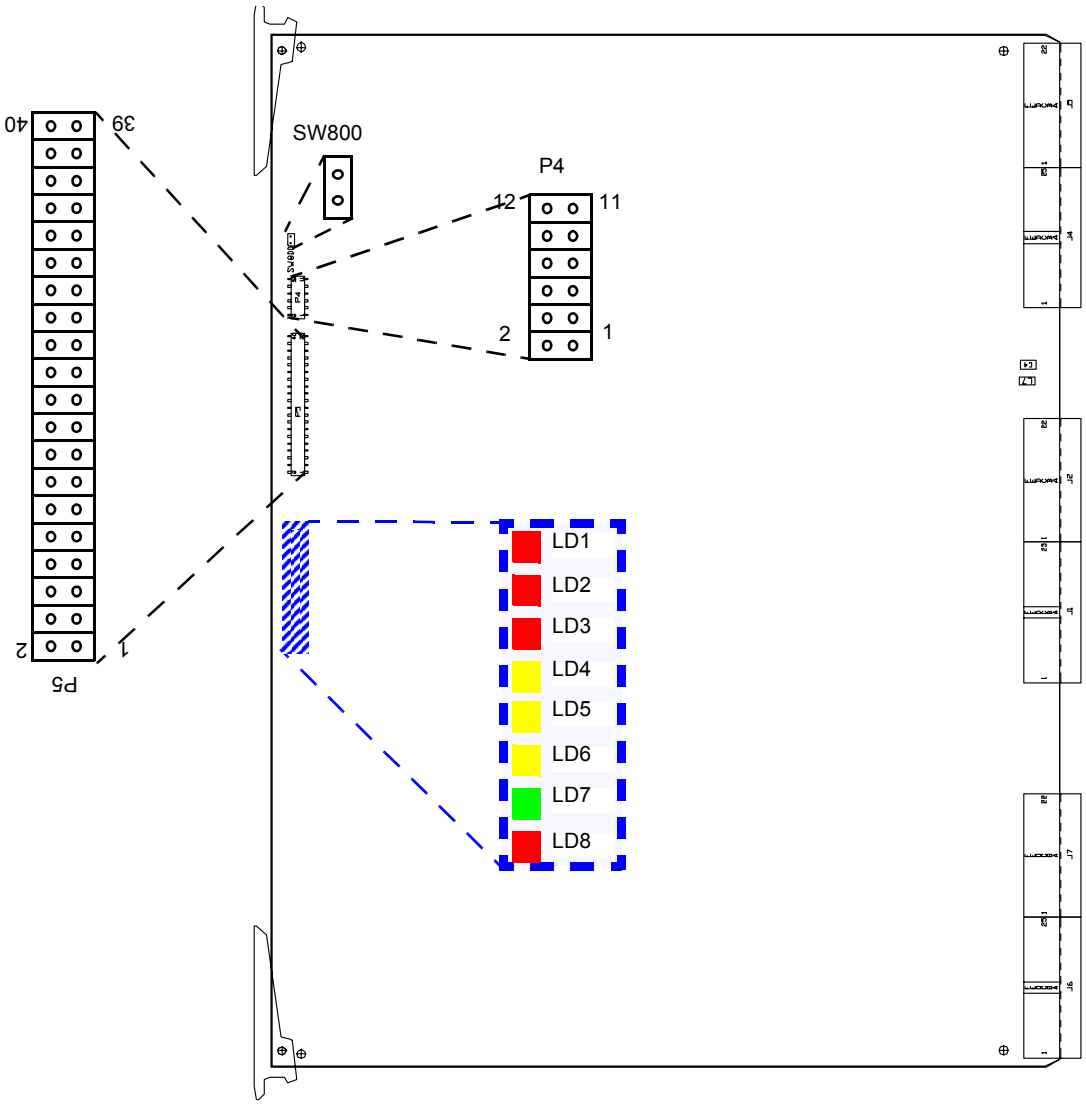


Figure 5-33 RFT, LEDs and Jumpers

5-11-8-7 LEDs

Table 5-49 LEDs on the RFT Board

LED #	LED Color	Description	Normally State
LD1	- Red	Board Failure	OFF
LD2	- Green	Board OK	ON
LD3	- Yellow	DSP Runs	BLINKING
LD4	- Yellow	Data Out on Pipelink	ON During Data Transfers to Pipelink
LD5	- Yellow	Spare	OFF
LD6	- Red	Clock Problems	OFF
LD7	- Red	Clock Problems	OFF
LD8	- Red	Clock Problems	OFF

5-11-9 Spectrum Doppler Processor Board, SDP

5-11-9-1 General Description

- This board performs Spectrum Analysis on the Doppler signals and makes the velocity traces,
- The Doppler audio channels are generated on this board.
- During Duplex modes (e.g. 2D and Doppler), The Missing Signal Estimator will fill the gaps in the Doppler spectrum by stretching the “real” spectrum out to fill the missing time.
- A serial link from the Internal I/O board, feeds the A/D converted traces (like ECG, Phono and Pressure) into the SDP. These signals are sent together with the Doppler data via the Pipelink bus to the Image Port Board.

5-11-9-2 Location in the Unit

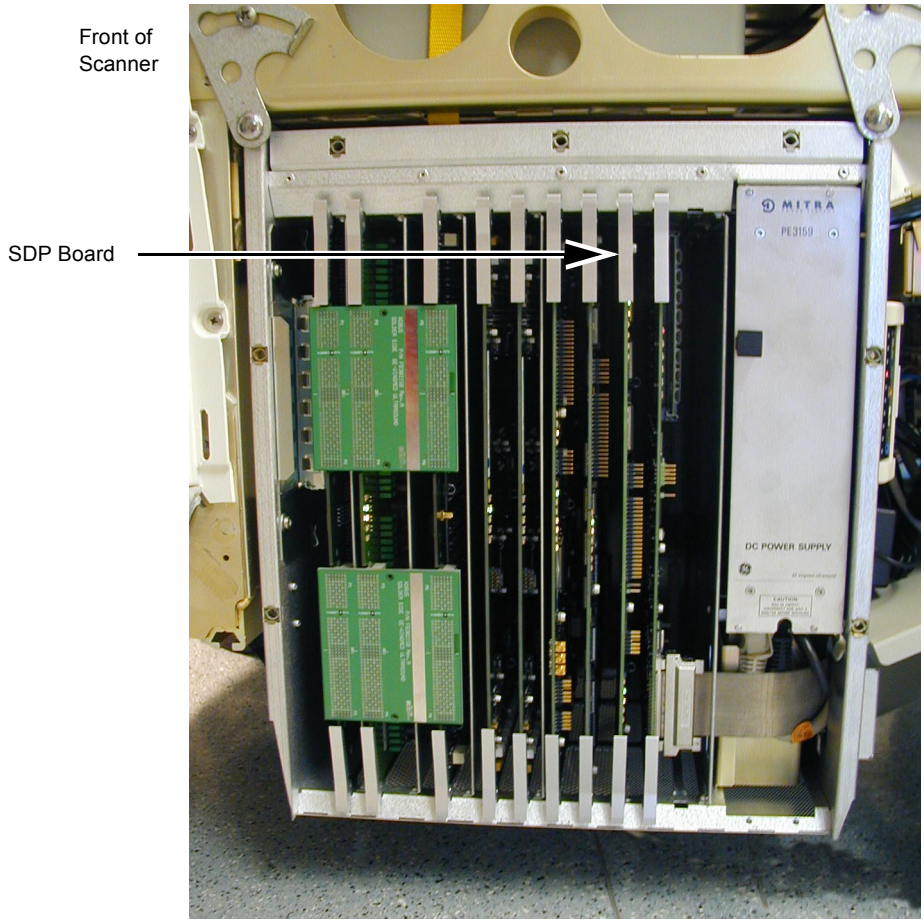


Figure 5-34 SPD Board: Location in Unit

5-11-9-3 Inputs

DC Voltages

Table 5-50 DC Output Voltages, Plug P3 & P4

Input	Description	Connection from:
+ 5 Vd	DC output voltage, distributed via Mother Board (Back Plane). The “d” indicates that this voltage is used for digital circuits.	DC Power Supply via Backplane
- 5 Va	DC output voltage, distributed via Mother Board (Back Plane). The “a” indicates that this voltage is used for analog circuits.	DC Power Supply via Backplane
GND	Distributed via Mother Board (Back Plane)	DC Power Supply via Backplane

Input Signals

Table 5-51 Input signals

Input	Description	Connection from:
Pipelink	Doppler Signals extracted	RFT Board
Serial Trace Data	Analog Traces	Patient I/O via Internal I/O
VME Bus	Data communication	BEP

5-11-9-4 Outputs

Output Signals

Table 5-52 Output Signals

Input	Description	Connection from:
Pipelink	Doppler Signals extracted	RFT Board
Audio Output	Analog Doppler (I and Q) signals to Front Panel speakers and VCR	Internal I/O
VME Bus	Data communication	BEP

5-11-9-5 Fuses and Dip-switches

None

5-11-9-6 LEDs and Jumpers

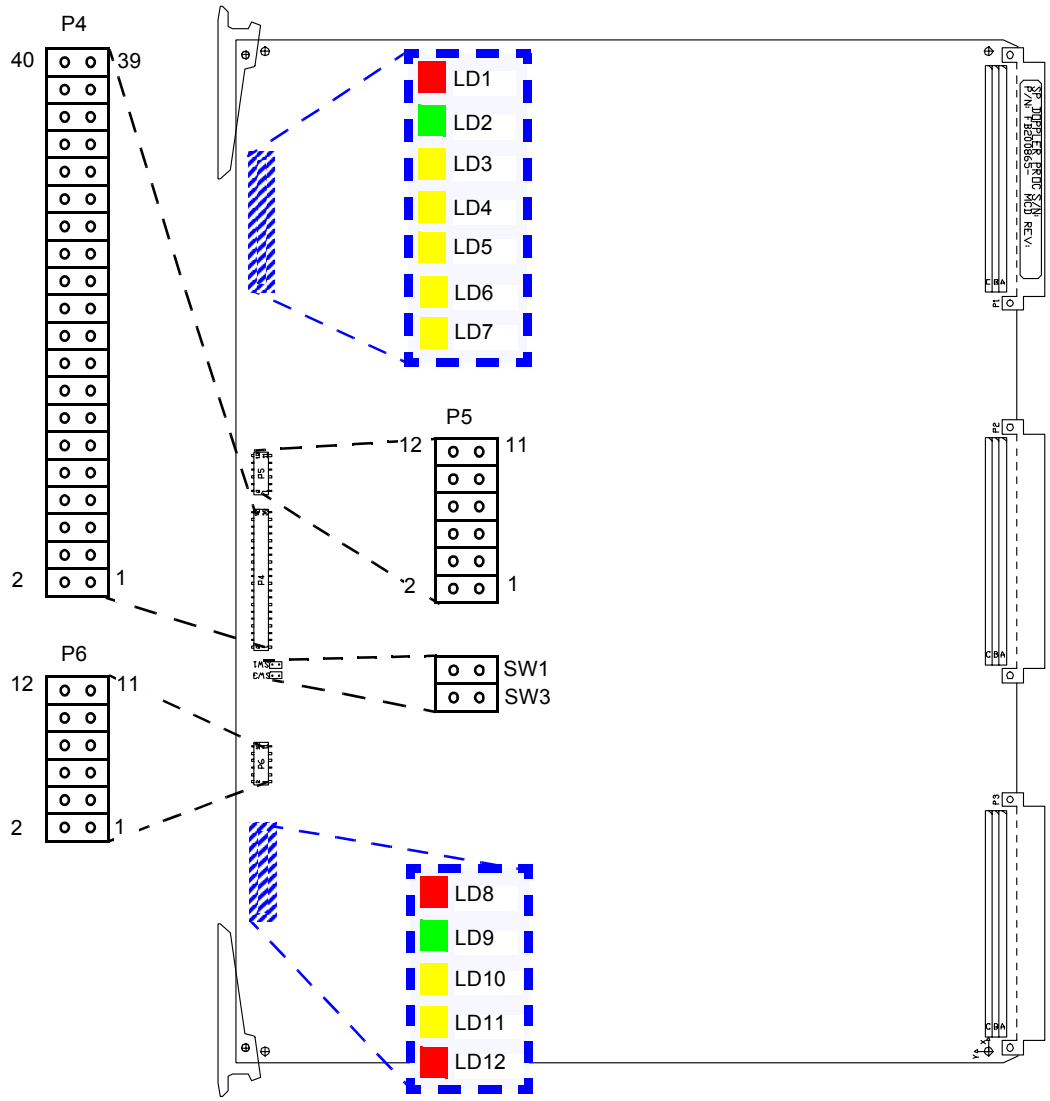


Figure 5-35 SDP, LEDs and Jumpers

Table 5-53 LEDs on the SDP Board

LED #	LED Color	Description	Normally State
Upper Batch of LEDs			
LD1	- Red	DSP1 Status	OFF. ON if errors/warnings detected.
LD2	- Green	Board OK	ON OFF if error detected.
LD3	- Yellow 0	DSP1 Local SW Running	FLASHING
LD4	- Yellow 1	DSP1 Ready for Data	ON when scanning, else OFF

Table 5-53 LEDs on the SDP Board

LED #	LED Color	Description	Normally State
LD5	- Yellow 2	DSP1 has received data	ON in Doppler mode, else OFF
LD6	- Yellow 3	Data Out on Pipelink	ON during data transfer to Pipelink FIFO
LD7	- Yellow 4	Audio Path OK	ON in Doppler Mode and audio present.
Lower Batch of LEDs			
LD8	- Red	Board Failure	Normally OFF ON if errors detected
LD9	- Green	Board OK	Normally ON OFF if errors detected
LD10	- Yellow	DSP2 Local Software Running	Flashing
LD11	- Yellow	Audio Path OK	ON in Doppler Mode and audio present.
LD12	- Red	Pipelink Clock Problem	OFF ON if SDP clock is out of phase with RFT clock. NOTE: If system is working and LED is ON: System OK.

5-11-10 Image Port 2 Board, IMP2

5-11-10-1 General Description

Image Port 2 (IMP2) can capture processed data live from the scanner, or video from the VCR, and stores this data to the appropriate locations in the internal Image Memory (on-board the IMP2 board).

These data will either be picked up by software running on the Backend Processor for scan converting and real time imaging, or by software for replay or history processing.

The following data types can be handled:

- 2-D Tissue Data
- Doppler Data
- M-Mode Data
- Color Flow Data
- Trace Data
- Video Y-Component Data
- Video UV-Component Data
- Color M-Mode Data
- RF Data
- Video (SVideo - PAL/NTSC, CVideo - PAL/NTSC)

5-11-10-2 Location in the Unit

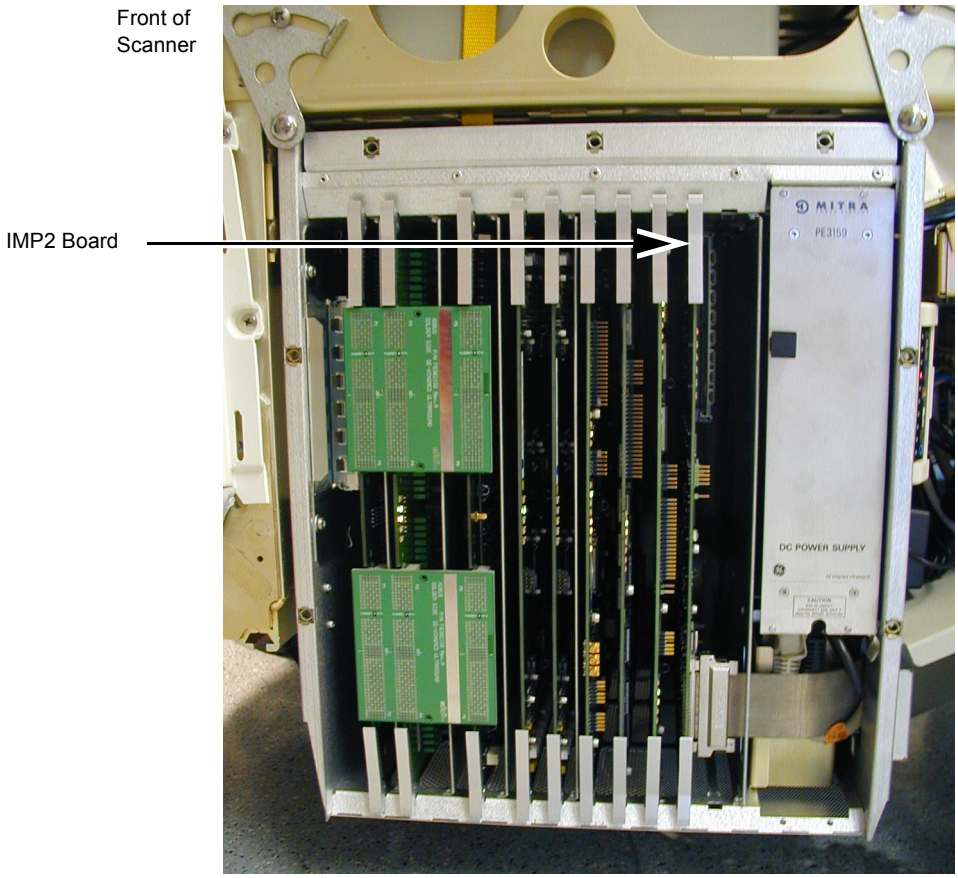


Figure 5-36 IMP2 Board: Location in Unit

5-11-10-3 Inputs

DC Voltages

Table 5-54 DC Output Voltages

Input	Description	Connection from:
+ 5 Vd	DC output voltage, distributed via Mother Board (Back Plane). The “d” indicates that this voltage is used for digital circuits.	DC Power Supply via Backplane
- 5 Va	DC output voltage, distributed via Mother Board (Back Plane). The “a” indicates that this voltage is used for analog circuits.	DC Power Supply via Backplane
GND	Distributed via Mother Board (Back Plane)	DC Power Supply via Backplane

Input Data

Table 5-55 Video and PipeLink Input Data

Input	Description	Connection from:
Pipelink	Live scan data	SDP
Video	Composite Video or Super VHS Video. Supported Formats: SVHS - PAL SVHS - NTSC PAL NTSC	VCR via Internal I/O

5-11-10-4 Outputs

Data to the Backend Processor

5-11-10-5 Fuses

None

5-11-10-6 Jumpers and Dip-switches

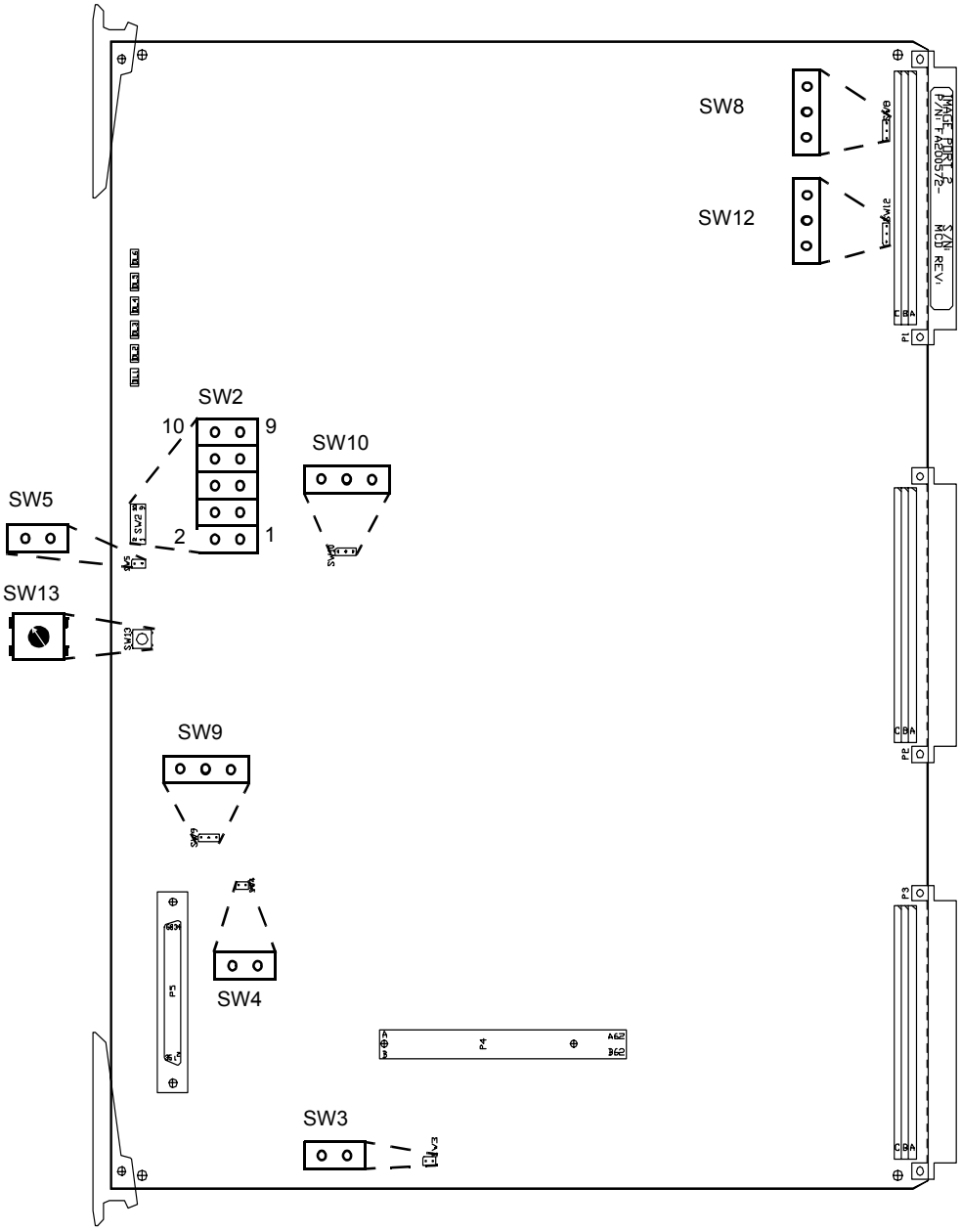


Figure 5-37 IMP2, Jumpers and Switch

5-11-10-7 LEDs

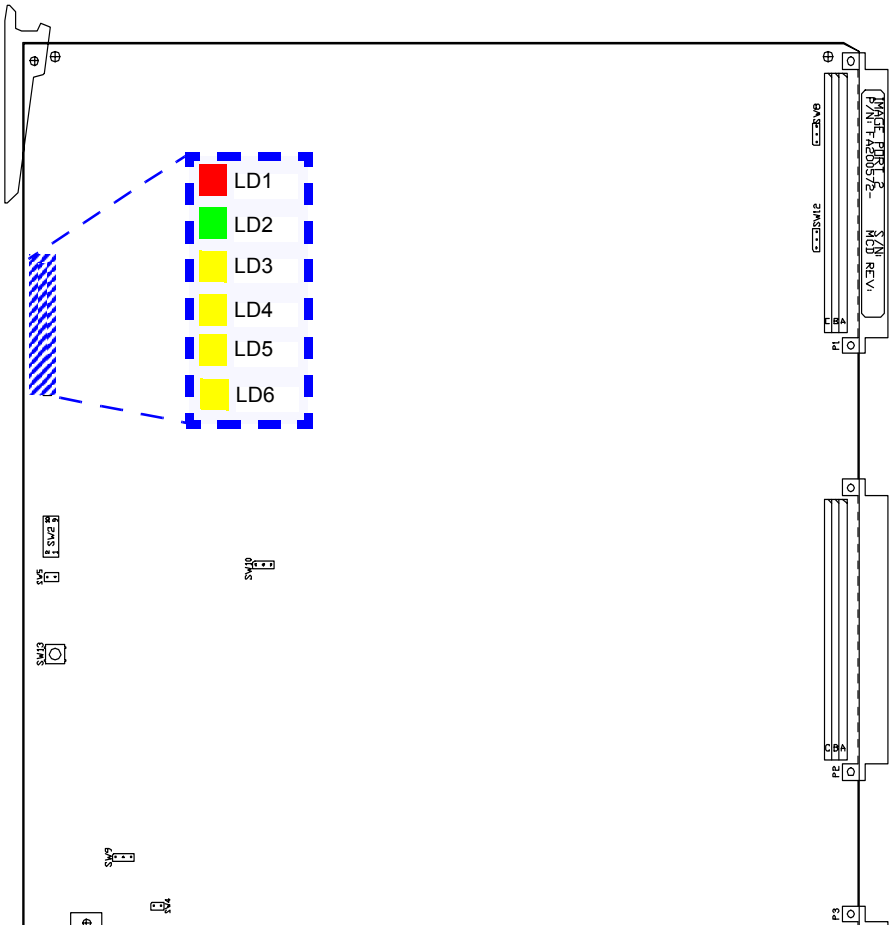


Figure 5-38 IMP2, LEDs

Table 5-56 IMP2, LEDs

LED #	LED Color	Description	Normally State
DL6	- Red	CPU self test failure or reset	Normally OFF
DL5	- Yellow	CPU addressing local bus	Dimmed light
DL4	- Yellow	Lit when firmware empties data FIFO to Image Memory	Dimmed light
DL3	- Yellow	Lit when IMP2 registers/FIFOs are accessed by the local CPU	Dimmed light
DL2	- Green	Board OK	Normally ON
DL11	- Red	Board Failure	Normally OFF

5-11-11 Backend Processor

5-11-11-1 General Description

See "Back End Processor" on page 5-14.

5-11-11-2 Location in the Unit

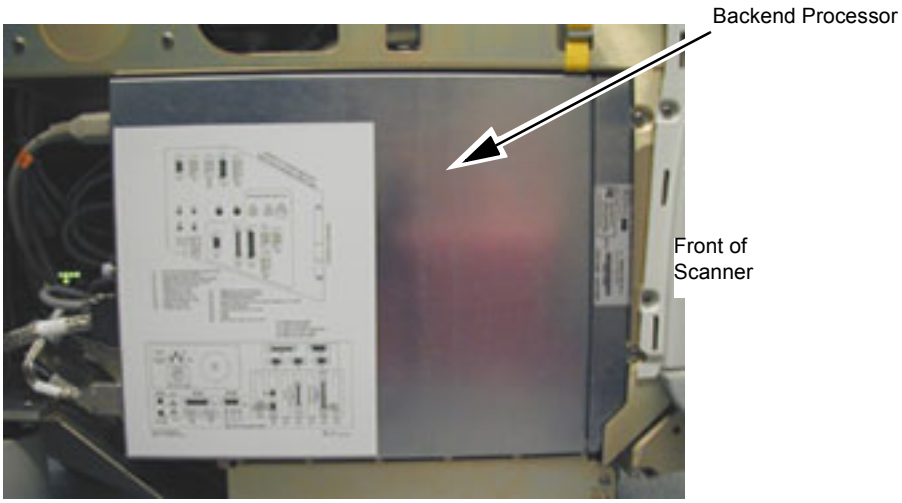


Figure 5-39 Backend Processor mounted in scanner

5-11-11-3 Inputs

AC Power

Table 5-57 AC Power

Input	Description	Connection from:
230 VAC	AC Power	AC Distribution Box > Backend Processor

DC Voltages

Table 5-58 DC Input Voltages

Input	Description	Connected to:
+5Vstb	Standby voltage	DC Power Supply via Backplane
GND	Electrical Ground	DC Power Supply via Backplane and I/O

5-11-11 Backend Processor (cont'd)

Input Signals

Table 5-59 Input Signals

Signal Name	Description	Signal Path
PWR_OK*	Power verification signal from Card Rack	Card Rack > IIO > PC2IO
ON/OFF Switch	Signal from the ON/OFF switch on the Control Panel and from the Reset button on the rear of the External I/O.	Top Console > IIO > PC2IO ON/OFF Reset (EIO) > IIO > PC2IO
I2C Register Interrupt	Interrupt signal from I2C Bus	EIO > IIO > PC2IO
Microphone in to BEP	Microphone signal from Monitor (Top Console)	Top Console > IIO > BEP
Audio in to BEP	Audio from VCR or Doppler Audio	Replay Audio from VCR > IIO > BEP Doppler Audio Out from Card Rack > IIO > BEP

5-11-11-4 Bi-directional Signals

Table 5-60 Bi-directional Signals

Signal Name	Description	Signal Path
UPS Control RS232	Control Signals to and from the UPS	BEP > IIO
RS232 XDCTRL	Not Used	PC2IO > IIO > Not Used
I2C Bus	Data bus used for Remote Control of External Units and for reading module versions.	PC2IO > IIO > EIO
Spare RS232	Not Used	PC2IO > IIO > Not Used
VCR Remote Ctrl (RS232)	Control signal to Internal VCR	PC2IO > IIO > VCR
USB #1	USB bus to Top Console	PC2IO > IIO > Top Console
COM 1	Not Used	PC2IO > IIO > EIO
COM 2	Modem	PC2IO > IIO > EIO (Rear of Module) > Modem
Ethernet	Standard TCP/IP Ethernet	BEP > IIO > EIO > External Network
USB #2	USB Bus for External Units	BEP > IIO > EIO > External USB Unit

5-11-11 Backend Processor (cont'd)

5-11-11-5 Outputs

Table 5-61 Output Signals

Signal Name	Description	Signal Path
+5VDC	DC Voltage	PC2IO > IIO
+12VDC	DC Voltage	PC2IO > IIO
PS_ON*	TBD (Active Low)	PC2IO > IIO > Card Rack
Standby	TBD	PC2IO > IIO > Top Console
SVideo	SVideo Out	PCVIC > PC2IO > IIO > EIO
CVideo	Composite Color Video	PCVIC > PC2IO > IIO > EIO
VGA	VGA High Resolution Video to External Video Screen	PCVIC > PC2IO > IIO > EIO
VGA	VGA High Resolution Video to Internal Video Screen (Top Console)	BEP > Top Console
BW Video RGB	BW Video from RGB. This signal is not used on Vivid 7 / Vivid 7 PRO	PCVIC > PC2IO > IIO > EIO This signal is not used on Vivid 7 / Vivid 7 PRO
Audio Out	Audio Out from BEP	BEP > IIO > Internal VCR BEP > IIO > EIO > External VCR
TRIG	Video Trig Signal	PC2IO > IIO > EIO

5-11-11 Backend Processor (cont'd)

5-11-11-6 UPS Battery

The UPS batteries provide power to the Back End Processor to enable a controlled shut down of the processor.

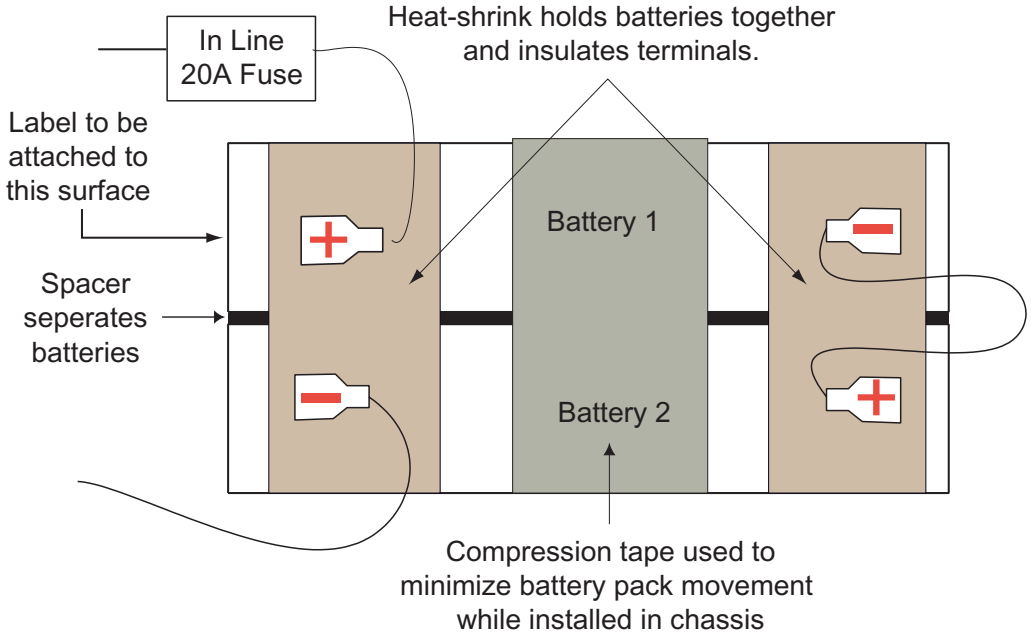


Figure 5-40 Battery Block Diagram



Figure 5-41 Battery pack

The UPS batteries will drain slightly when the system is in the off condition. The off condition is defined as:

- Circuit Breaker in the OFF position
- System unplugged from the wall outlet

If the system is left in the OFF condition for an extended period of time (3 to 5 days or more), the system may not boot up or may beep when turned ON. Should this occur, the system needs to recharge the UPS batteries. This could take 15 minutes to as long as 24 hours, depending on the battery age, system input voltage and system temperature. To eliminate draining the UPS batteries, the system should remain plugged into the wall outlet with the circuit breaker in the ON position.

5-11-12 Patient I/O

5-11-12-1 General Description

The Patient I/O contains the electronics for ECG, Phono and two analog inputs. One of the analog inputs has programable gain. The module extracts respiration from ECG. The patient leads can be rotated by software (i.e. it is possible to change between Lead I, II and III by pushing a button) The electronics also contains a pacemaker detector. The four inputs are separately isolated because of safety requirements.

5-11-12-2 Location in the Unit

Inside the Backend Processor with the connector panel available from the front of the system.

5-11-12-3 Inputs

- ECG
- Phono
- Two Analog Inputs

5-11-12-4 Outputs

Serial Trace Data via Internal I/O to the SPD Board

5-11-13 Internal I/O

5-11-13-1 General Description

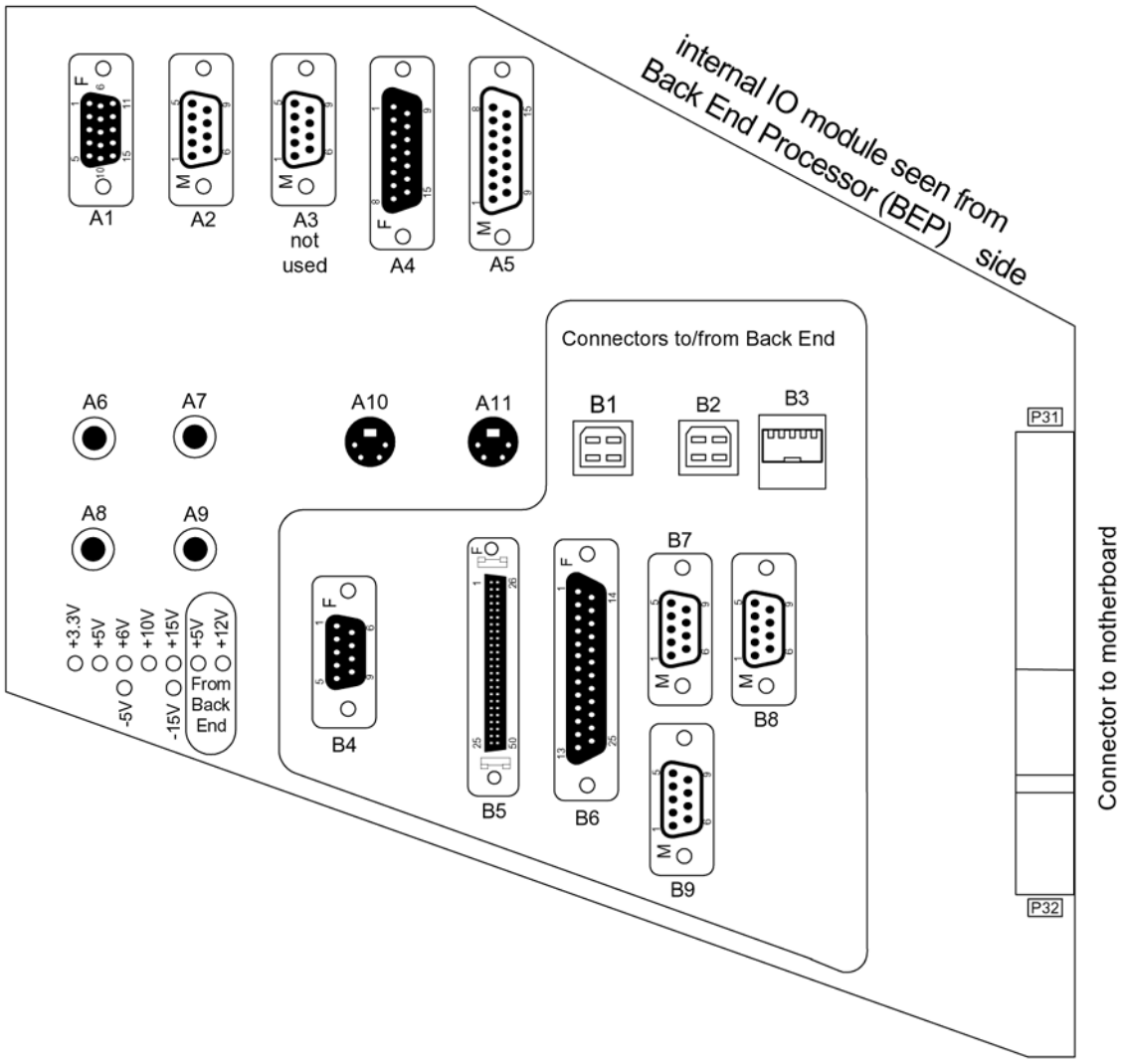


Figure 5-42 The Internal I/O Module seen from the BEP Side

The Internal I/O Module distributes signals and DC Voltages from and to different parts of the system.

- Video and audio signals are distribution between the Backend Processor, External I/O, Top Console and peripherals.
- USB, Ethernet and RS232 signals are routed from the Backend Processor to the External I/O for external communication.
- USB signals are routed between the Backend Processor and the user interface.
- Serial Bus signals are routed from the Backend Processor to control VCR and UPS.
- Signals for power- and fan control are routed trough the module.

The module has direct board-to-board connections with the motherboard and the External I/O Module. All other connections are done via cables.

5-11-13-2 Location in the Unit

The Internal I/O Module is plugged into the Card Rack (at the end nearest to the rear of the system).

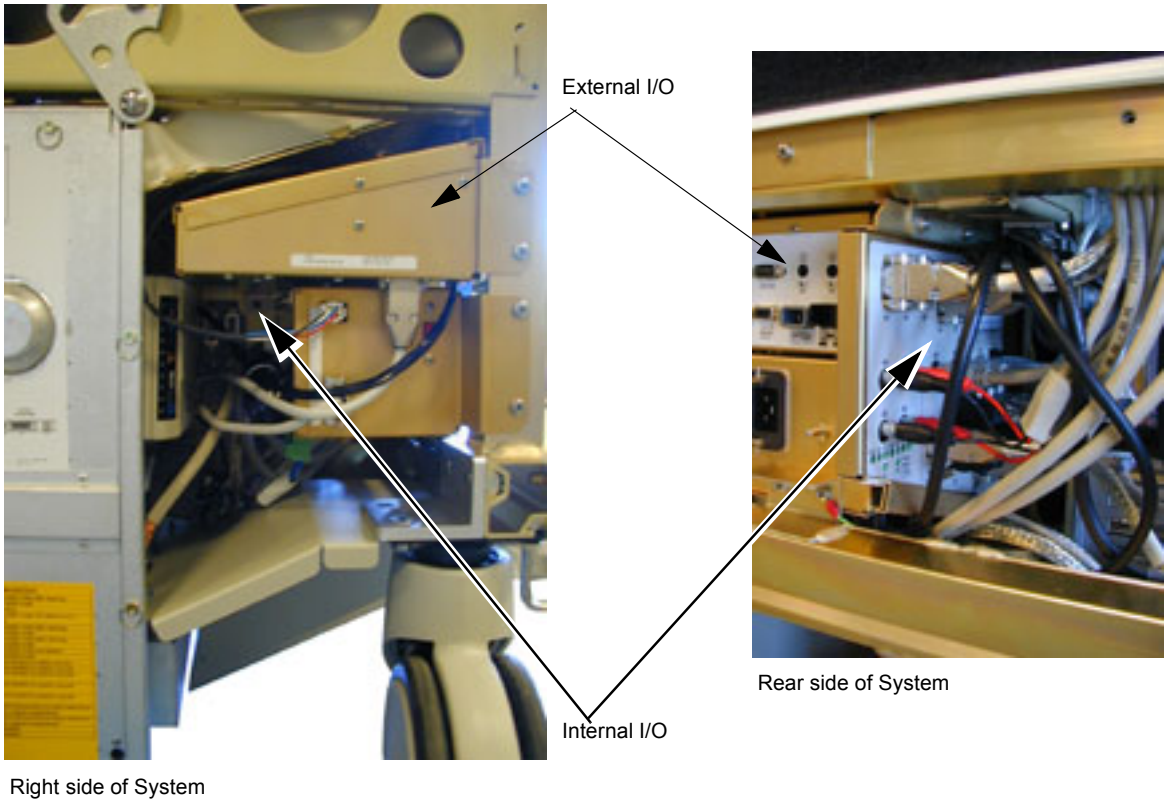


Figure 5-43 Internal I/O: Location in the System (Seen from Right and Rear Side)

5-11-13-3 Inputs

DC Voltages

Table 5-62 DC Input Voltages

Input	Description	Connection from
+3.3 VDC	Input DC Voltage	DC Power Supply > Backplane > J32
+5 VDC	Input DC Voltage	DC Power Supply > Backplane > J32
+10 VDC	Input DC Voltage	DC Power Supply > Backplane > J32
+15 VDC	Input DC Voltage	DC Power Supply > Backplane > J32
-15 VDC	Input DC Voltage	DC Power Supply > Backplane > J32
+6 VDC (analog)	Input DC Voltage	DC Power Supply > Backplane > J32
–5 VDC (analog)	Input DC Voltage	DC Power Supply > Backplane > J32
+5 VDC	Input DC Voltage	Backend Processor > J17
+12 VDC	Input DC Voltage	Backend Processor > J17)

Video Input Signals

Table 5-63 Video Input Signals

Input	Description	Connection from
SVGA	Video Signal to External I/O	PC2IO (Connector J16)
SVHS	Video Signal to VCR & External I/O	PC2IO(Connector J16)
SVHS	Video Signal to MBD (IMP)	VCR (Connector J11)
Luma	Video Signal to B&W Printer and External I/O	PC2IO (Connector J16)
Comp. Video	Video Signal to External I/O	PC2IO (Connector J16)
Comp. Video	Video Signal to MBD (IMP)	Color printer

5-11-13-3 Inputs (cont'd)

Audio Input Signals

Table 5-64 Audio Input Signals

Input	Description	Connection from
Two channel audio	Audio signals, summed and distributed	MBD (IMP)
Two channel audio		VCR
Two channel audio		BEP

Serial Ports

Table 5-65 Serial Ports

Input	Description	Connection from
USB	Standard USB Serial Bus	BEPM - Top console
USB	Standard USB Serial Bus	BEPM - IEIO
Ethernet	Standard Ethernet	BEPM - IEIO
RS232	Standard RS232 Serial Bus	BEPM COM1 - IEIO
RS232	Standard RS232 Serial Bus	BEPM COM2 - IEIO
RS232	Standard RS232 Serial Bus	PC2IO - Spare (J16)
RS232	Standard RS232 Serial Bus	PC2IO - VCR (J16)
RS232		PC2IO - Color printer (Connector J16)
RS232		PC2IO – UPS (Connector J16)

5-11-13-3 Inputs (cont'd)

Control Signals

Table 5-66 Control Signals

Input	Description	Connection from
Control signals	Spare	MBD/FEC (Connector J??)
Control signals	Spare	MBD/FEC (Connector J??)
Trace trigger	To EIO	PC2IO (Connector J16)
Fan control signals	To AC Power	MBD (Connector J??)
Power control signals	To MBD and AC Power	PC2IO (Connector J16)
Power on/off	To Relay	Top Console ON/OFF Switch and EIO Test (Connector J??)
Standby	To Top Console	PC2IO (Connector J16)

5-11-13-4 Outputs

DC Voltage

Table 5-67 DC Output Voltages

Output	Description	Connection to
+5 VDC +12 VDC	From BEP	Spare (Connector J21)
+5 VDC, -15 VDC, -5 VDC $_{analog}$	From Card Rack	
+5 VDC +12 VDC	From BEP	Not Used
+5 VDC, -15 VDC, -5 VDC $_{analog}$	From Card Rack	
+5 VDC, +15 VDC,	From Card Rack	Not Used
+12 VDC	From BEP	Top Console
+15 VDC	From Card Rack	
+5 VDC +12 VDC	From BEP	EIO
+5 VDC, +15 VDC, -5 VDC $_{analog}$ +6 VDC $_{analog}$	From Card Rack	

AUDIO

Table 5-68 Audio Outputs

Output	Description	Connection to
Audio (two channels)	Audio (Doppler sound) from MBD (IMP), VCR, BEP	Top Console speakers and BEP
		VCR and IEIO

5-11-13-4 Outputs (cont'd)

Interface Connectors – Component Side

Table 5-69 Connectors, Component Side

Input	Description	Connection from
A1/J1	B&W printer, 15pins HD-sub, female.	
A2/P4	VCR remote ctrl – RS232: 9pins D-sub, male.	
A3/P5	Color printer - RS232: 9pins D-sub, male.	
A4/J2	Top Console - Power & signals: 15pins D-sub, female.	
A5/P4	Top Console - Signals: 15pins D-sub, male.	
A6/J6	Audio out to VCR, left: Phono jack.	
A7/J7	Audio out to VCR, right: Phono jack.	
A8/J8	Audio in from VCR, left: Phono jack.	
A9/J9	Audio in from VCR, right	
A10/J10	SVHS out to VCR	
A11/J11	SVHS in from VCR	
B1/J12	USB to Top console	
B2/J13	USB to external I/O	
B3/J14	Ethernet	
B4/J15	Audio I/O	
B5/J16	PC2IO signals	
B6/J17	PC2IO power	
B7/P18	COM1	
B8/P19	COM2	
B9/P25	UPS remote control	
J32	MBD – signals and power	

5-11-13-4 Outputs (cont'd)

Table 5-70 Connectors, Solder side

Input	Description	Connection from
A12/J21	Spare power, 15pins D-sub, female	
A13/J20	Spare – power, 15pins D-sub, female	
A14/J24	AC power ctrl, 9pins D-sub, female	
A15/P23	Rotation adapter – signals, 15pins D-sub, male	
A16/P22	Spare – signals, 25pins D-sub, female	
P30	EIO – signals and power, 110pins male	

5-11-13-5 Fuses

All output voltages are fused

5-11-13-6 Jumpers and Dip-switches

TBD

5-11-13-7 LEDs



Figure 5-44 Internal I/O: Green LEDs for Power Status.

5-11-14 External I/O

5-11-14-1 General Description

The External I/O is the interface between the scanner and all external devices.

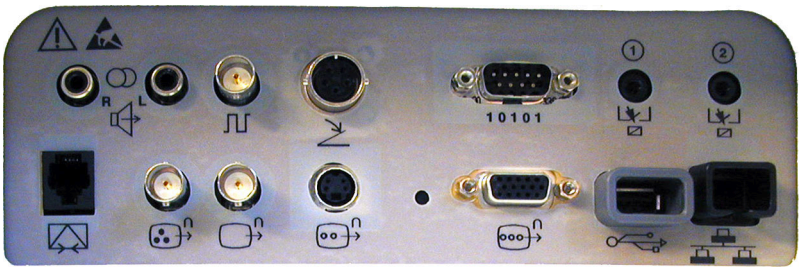


Figure 5-45 External I/O Connector Panel

5-11-14-2 Location in the Unit

On the rear of the scanner, above the power inlet and power breaker.

5-11-14-3 Input Signals

Table 5-71 Input Signals

Input	Description	Connection from/via/to
Footswitch Connector	Footswitch is a mechanical switch that connect a signal to ground. Internal level is TTL (0-3.3V)	Footswitch > External I/O > Internal I/O > PC2IO (BEP)
DC Voltages from BEP		
+5 VDC	Used for Optical Couplers on RS232 signals	PC2IO (BEP) > Internal I/O > External I/O
+12 VDC		
DC Voltages from Card Rack		
+5 VDC	Used for Optical Couplers on Footswitch	Card Rack > Internal I/O > External I/O
+15 VDC		
-5 VDC $_{analog}$		
+6 VDC $_{analog}$		

5-11-14-4 Bi-directional Signals

Table 5-72 Bi-directional Signals

Signal Name	Description	Signal Path
Ethernet	Standard 10/100 Base TX Ethernet	Ethernet - External I/O - Internal I/O - BEP (Ethernet Connector)
COM1	Serial RS-232 port (Not used in Vivid 7 / Vivid 7 PRO)	External Device - External I/O - Internal I/O - BEP (COM1)
USB	Standard USB (Universal Serial Bus), (0-5V)	USB Device - External I/O - Internal I/O - BEP (USB #2))
Modem	Internal Modem Telephone Line Connection	Analog Phone Line - External I/O (Connector Panel) - External I/O (Rear Side)- Modem
COM2	Serial RS-232 port (on rear side of External I/O)	Modem - External I/O (Rear Side) - Internal I/O - BEP (COM1)
Burn-in Power On/ Off Control	Burn-in Power On/Off Control (on rear side of External I/O) - Used for factory testing.	External I/O (Rear Side) - Internal I/O

5-11-14-5 Output Signals

Table 5-73 Output Signals

Signal Name	Description	Signal Path
Stereo Audio	Stereo audio to external VCR. (Same signal as delivered to internal VCR).	Audio Source (Internal VCR/ Microphone/BEP) > Internal I/O > External I/O > External VCR.
Composite Video	External composite video, 1.0Vp-p, 75 ohms, unbalanced, sync negative.	PC2IO (BEP) > Internal I/O > External I/O > External Composite Video Device
Super Video (SVHS)	Super Video Luminance: 1.0Vp-p, 75 ohms, unbalanced. Color: 1.0Vp-p, 75 ohms, unbalanced.	PC2IO (BEP) > Internal I/O > External I/O > External VCR
Black and White video	External black and white video 1.0Vp-p, 75 ohms, unbalanced, sync negative.	PC2IO (BEP) > Internal I/O > External I/O > External B/W Video Device
Trig	Trigger Signal, 0-3.3V	
SVGA	SVGA (RGBS) high resolution video output (Same signal as sent to the systems monitor)	PCVIC > PC2IO (BEP) > Internal I/O > External I/O > External Monitor
Remote Expose #1	A SW controllable relay, to control external peripherals	PC2IO (BEP) > Internal I/O > External I/O > External Peripheral
Remote Expose #2	A SW controllable relay, to control external peripherals	PC2IO (BEP) > Internal I/O > External I/O > External Peripheral

5-11-14-6 Fuses (internal in unit)

- F400-403
- F800-804
- F200-201
- F300

5-11-14-7 Jumpers and Dip-switches

None

5-11-14-8 LEDs

None

5-11-15 Interconnect Cabling

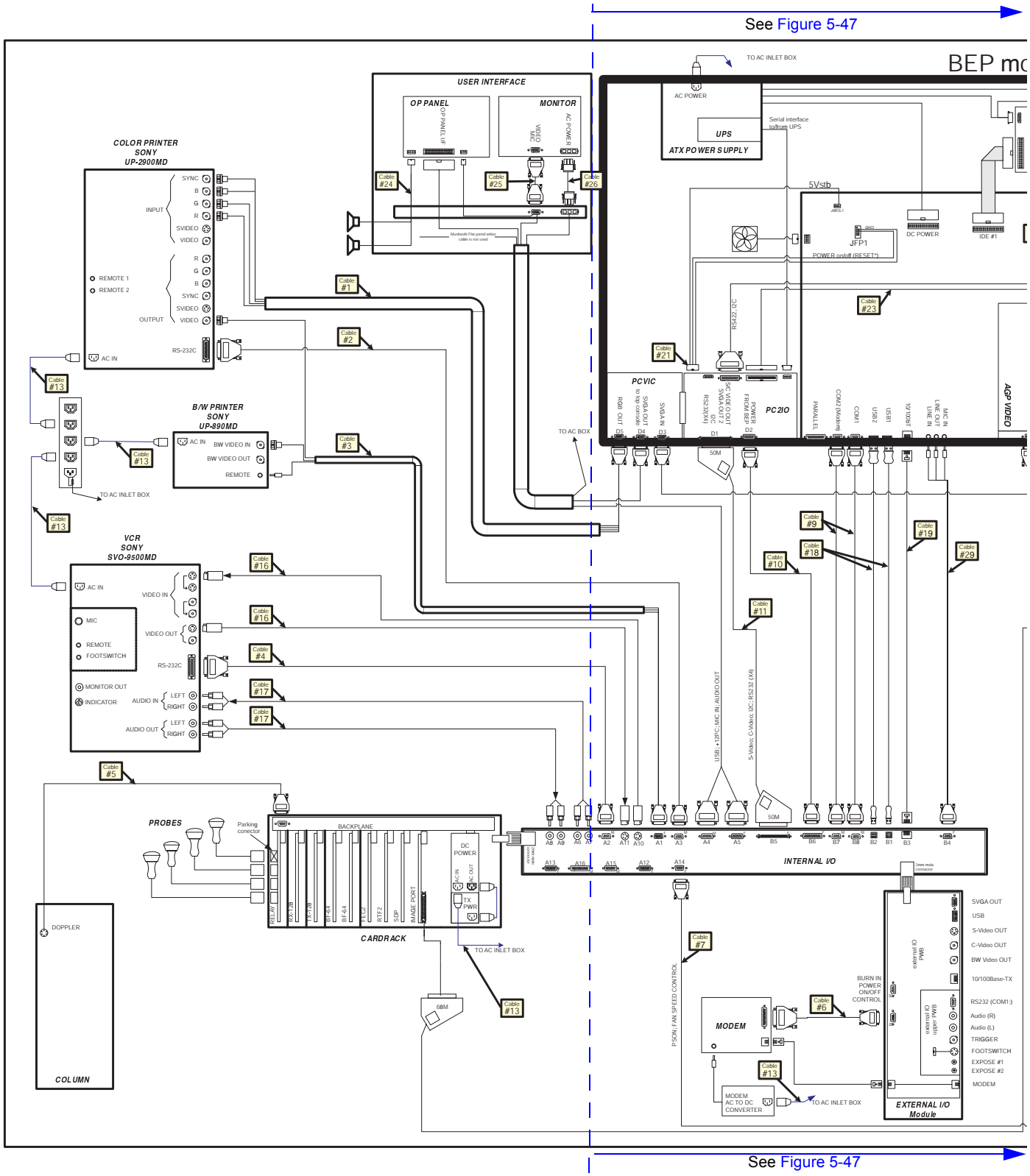
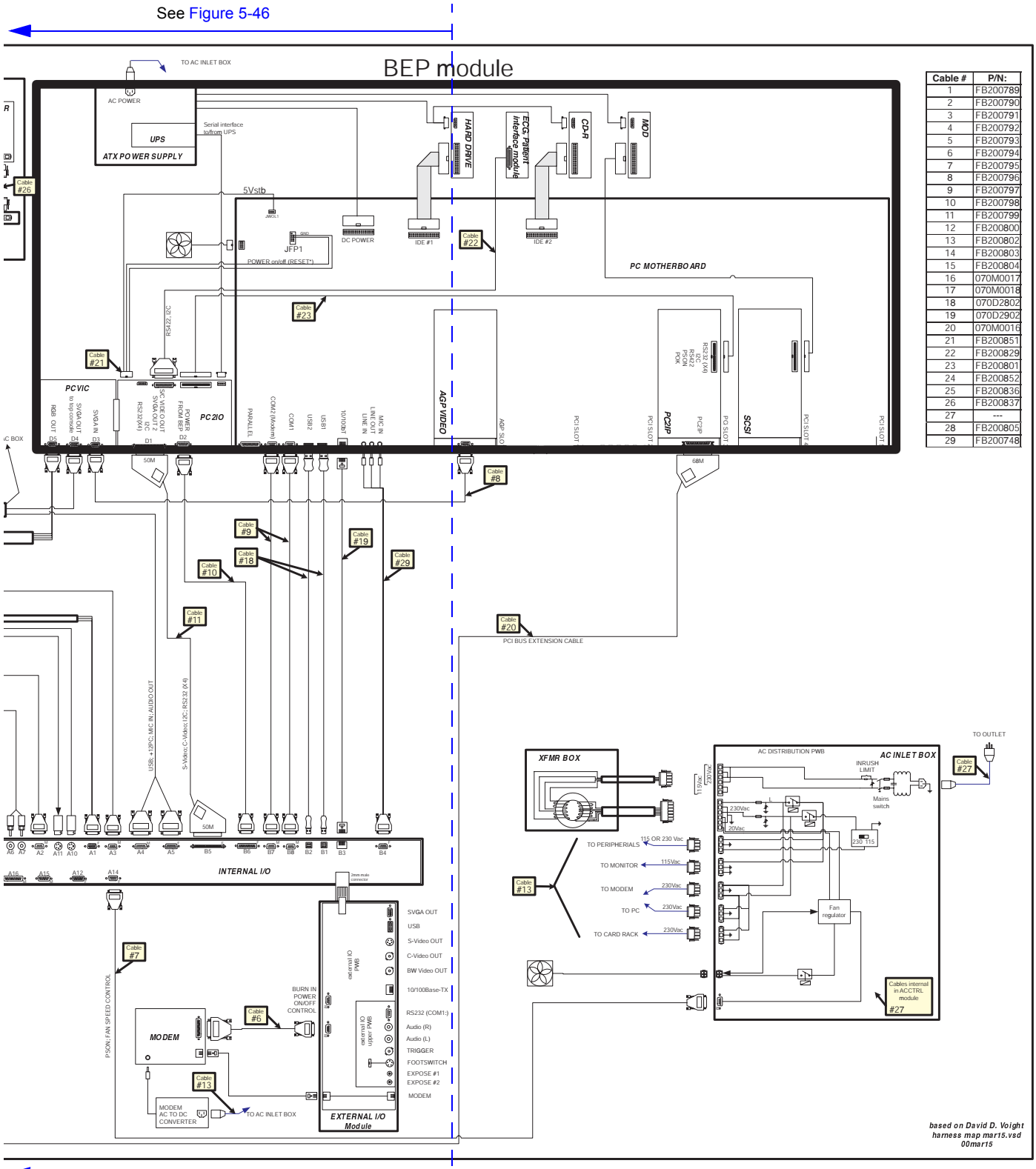


Figure 5-46 Vivid 7 / Vivid 7 PRO Interconnect Cabling, (Left Part of Drawing)

5-11-15 Interconnect Cabling (cont'd)



Cable #	P/N:
1	FB200789
2	FB200790
3	FB200791
4	FB200792
5	FB200793
6	FB200794
7	FB200795
8	FB200796
9	FB200797
10	FB200798
11	FB200799
12	FB200800
13	FB200802
14	FB200803
15	FB200804
16	070M0017
17	070M0018
18	070D2802
19	070D2902
20	070M0016
21	FB200851
22	FB200829
23	FB200801
24	FB200852
25	FB200836
26	FB200837
27	---
28	FB200805
29	FB200748

Figure 5-47 Vivid 7 / Vivid 7 PRO Interconnect Cabling (Right Part of Drawing)

5-11-16 Motherboard (Back Plane)

5-11-16-1 General Description

The Motherboard is the Card Rack's Back Plane. It distributes DC Voltages from the DC Power to all the boards in the Card Rack and interconnects (distributes signals and data buses between) the different boards.

5-11-16-2 Location in the Unit

Rear of Card Rack.

5-11-16-3 Inputs

See the different board's description

5-11-16-4 Outputs

See the different board's description

5-11-16-5 Fuses

None

5-11-16-6 Jumpers and Dip-switches

None

5-11-16-7 LEDs

None

5-11-17 Modem

5-11-17-1 General Description

The modem is a standard MultiTech modem that connects to an analog phone line.

5-11-17-2 Location in the Unit

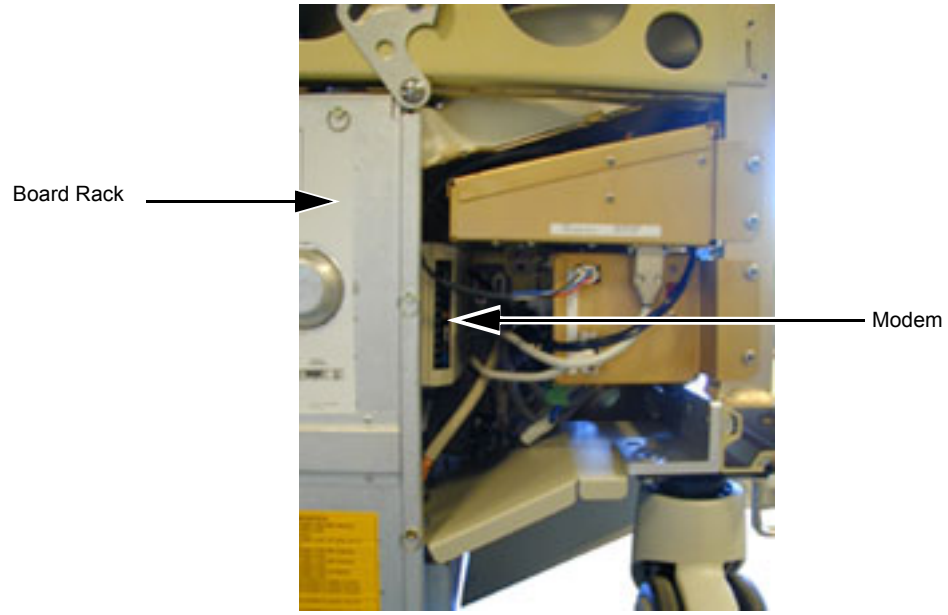


Figure 5-48 Modem: Location in Unit

5-11-17-3 Inputs/Outputs

- DC Voltage from Modem Power (AC/DC Converter)
- RS232 from Backend Processor via Internal I/O and External I/O
- Analog Phone line via External I/O

5-11-17-4 Fuses

None

5-11-17-5 Jumpers and Dip-switches

None

5-11-17-6 LEDs

The Modem has ten LEDs on its front.



Figure 5-49 LEDs on Modem's Front Panel

Table 5-74 LEDs on Modem

LED Color	Description	Normally State
- Red	TD (Transmit Data)	Flashes during use.
- Red	RD (Receive Data)	Flashes during use.
- Red	CD (Carrier Detect)	ON when detecting a carrier from another modem and during communication. OFF indicates no or broken connection.
- Red	56 (56K Mode)	During Power On: Briefly Flashing These LEDs indicates communication speeds above 14 kbs. If one of this LEDs are ON during communication, it will stay ON until the modem is reset or connected the next time. At speeds below 14 kbs, these LEDs are OFF.
- Red	33 (V.34 Mode)	
- Red	14 (V.32bis Mode)	
- Red	OH (Off hook)	ON when dialing, online, or answering a call Flashes if puls dialing Off when modem not in use
- Red	TR (Terminal Ready)	ON when the system initializes the modem. It indicates that the modem is ready for an outgoing or incoming call. OFF indicates that communication on the RS232 (COM) port has been broken. The connected (remote) modem will disconnect.
- Red	EC (Error Correction (V.42))	ON: Error Correction (V42) is turned ON Blinking: Compression turned ON OFF: Normal operation.
- Red	FX (Fax)	Always OFF

Section 5-12
Video Specifications

5-12-1 PAL

Table 5-75 PAL Video Specification

Horizontal Timing		
Horizontal Total (HT)	us	944 pixels
Horizontal Start (HS)	us	152 pixels
Horizontal Active (HA)	us	768 pixels
Pixel Clock Freq	14.7 MHz	(PAL)
Vertical Timing (Interlaced)		
Vertical Start (VS)	53 Lines / field	
Active Lines (VA)	Lines / frame	(=PAL standard)
Total Lines (VT)	625 Lines / frame	(=PAL standard)
Frame Rate	25Hz	(=PAL standard)

5-12-2 NTSC

Table 5-76 NTSC Video Specification

Horizontal Timing		
Horizontal Total (HT)	us	780 pixels
Horizontal Start (HS)	us	118 pixels
Horizontal Active (HA)	us	640 pixels
Pixel Clock Freq	12.272725 MHz	(NTSC)
Vertical Timing (Interlaced)		
Vertical Start (VS)	17 Lines / field	
Active Lines (VA)	(525 - 17) Lines / frame	(=NTSC standard)
Total Lines (VT)	525 Lines / frame	(=NTSC standard)
Frame Rate	30Hz	(=NTSC standard)

Section 5-13
System Logs

The available logs can be viewed via the Common Service Interface, see "Error Logs" on page 7-7.

Section 5-14
Board Rack Cooling System

5-14-1 General Description

The Board Rack cooling system includes following components:

- Dust Filter
- Dust Filter Frame
- Air Inlet channel
- Fan Assembly

Other components that influence on the airflow is the Board Rack itself. The air is sucked in from the rear side of the system through the Filter Cover and the Filter. It passes the Fan Assembly directly into the upper part of the rear side of the Board Rack and makes a cooling air current between the Boards before it blows out against the floor. See Figure 5-50.

5-14-2 Location in the Unit

The Fan Assy is located between the Board Rack and the Filter, which can be seen on the rear side of the System.

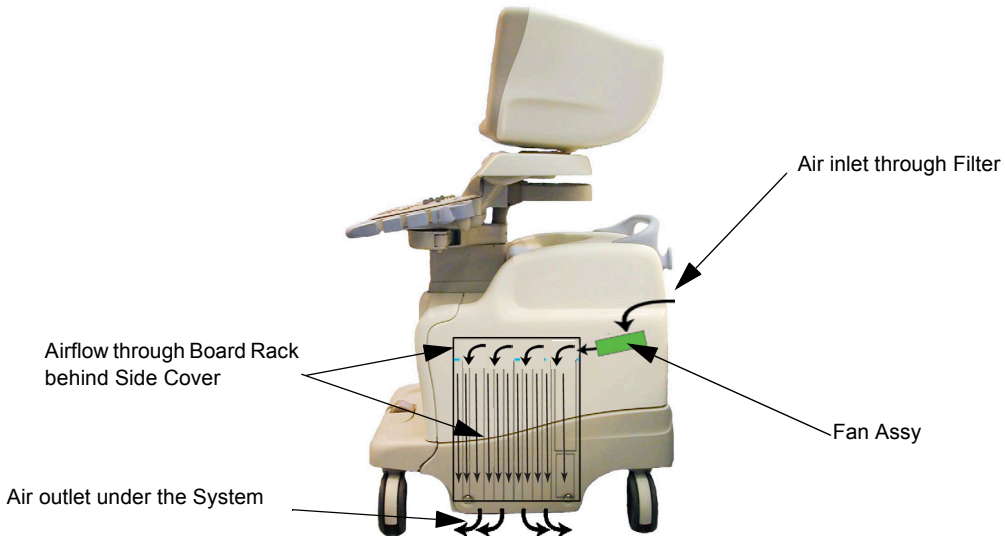


Figure 5-50 Airflow through the System

Section 5-15
Top Console Movement

5-15-1 General Description Vivid 7

(Vivid 7 PRO - see section 5-15-5 on page 5-100)

The Top Console includes Monitor, Monitor Shelf, Speakers and Operator Panel. The Console's movement backwards and forwards and to the sides is made possible by the Frogleg unit that links the Console to the rest of the System in a flexible multi movement joint. The handle (XY-release Handle) that unlocks the Frogleg, is located in the center lower side of the Front Handle.

The Top Console can also be moved up and down. The handle (Z-release Handle) is located in the left grip of the Front Handle. A gas spring inside the system assists in the Z movement. It is actuated by pulling the Z-release Handle and at the same time lifting up or pushing down the Console with some pressure to assist up/down motion.

A flexible harness of electrical and mechanical wires secures the connection between the Top Console and rest of the System.

5-15-2 Transportation of Vivid 7 / Vivid 7 PRO

The Console must be locked into the center (x/y) position before transporting the system as indicated on the label on the Front Handle.

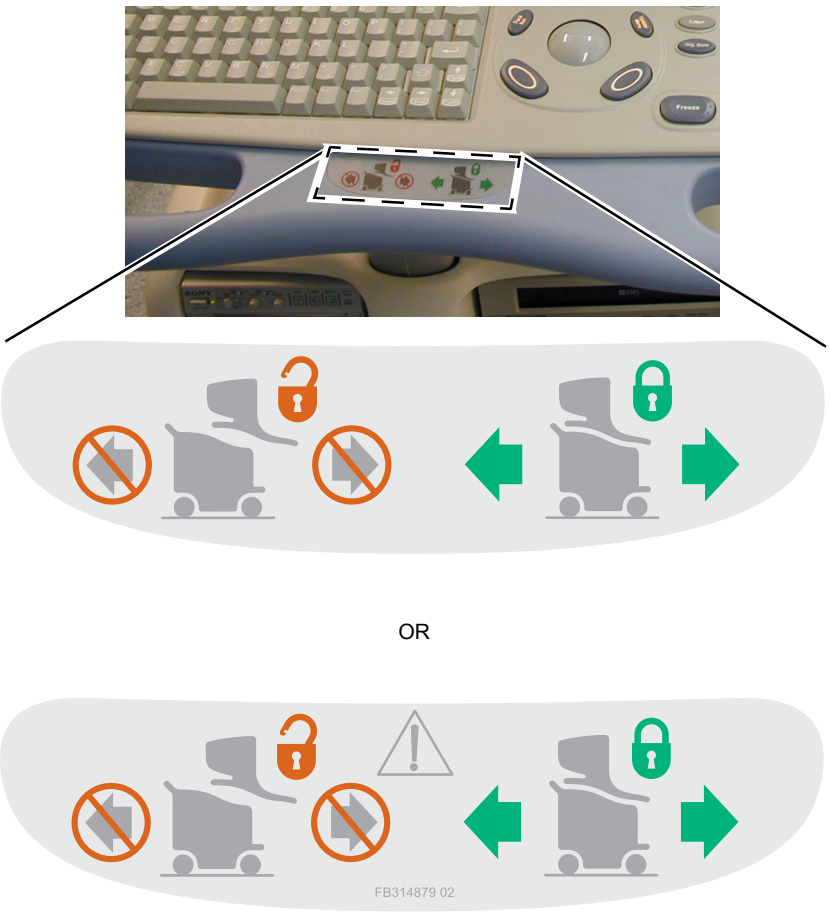


Figure 5-51 Label on Front Handle

5-15-3 Location in the Unit

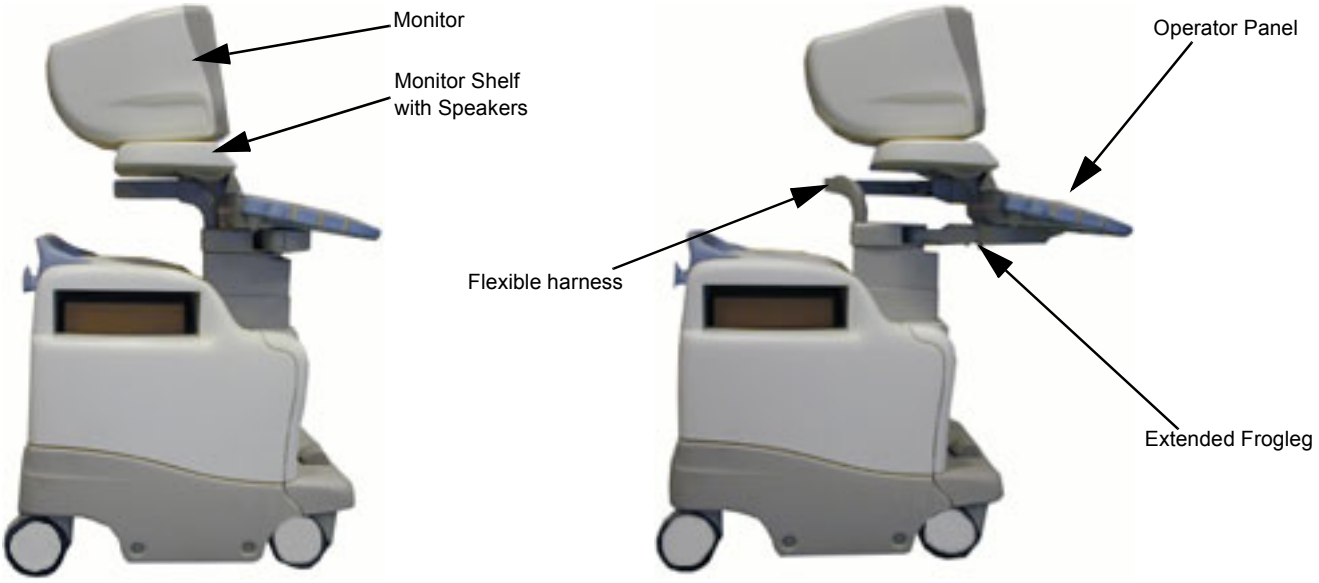


Figure 5-52 Top Console, upper positions

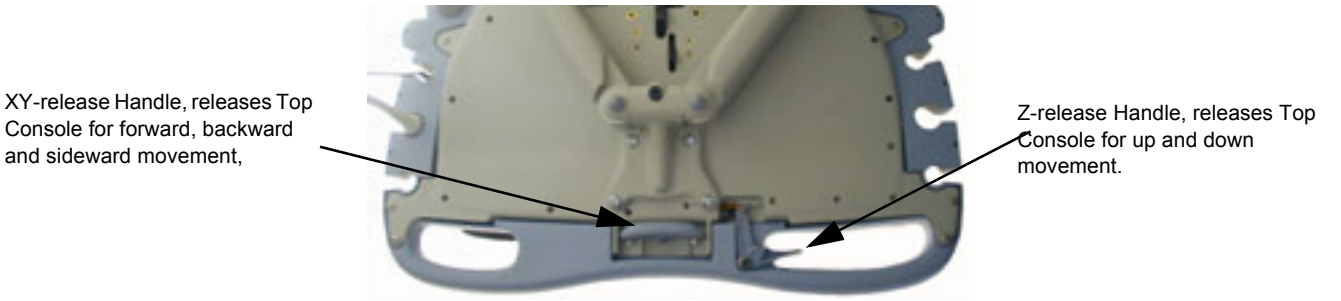

XY-release Handle, releases Top Console for forward, backward and sideward movement,
Z-release Handle, releases Top Console for up and down movement.

Figure 5-53 Release Handles location (seen from the below the Top Console)

5-15-3 Location in the Unit (cont'd)

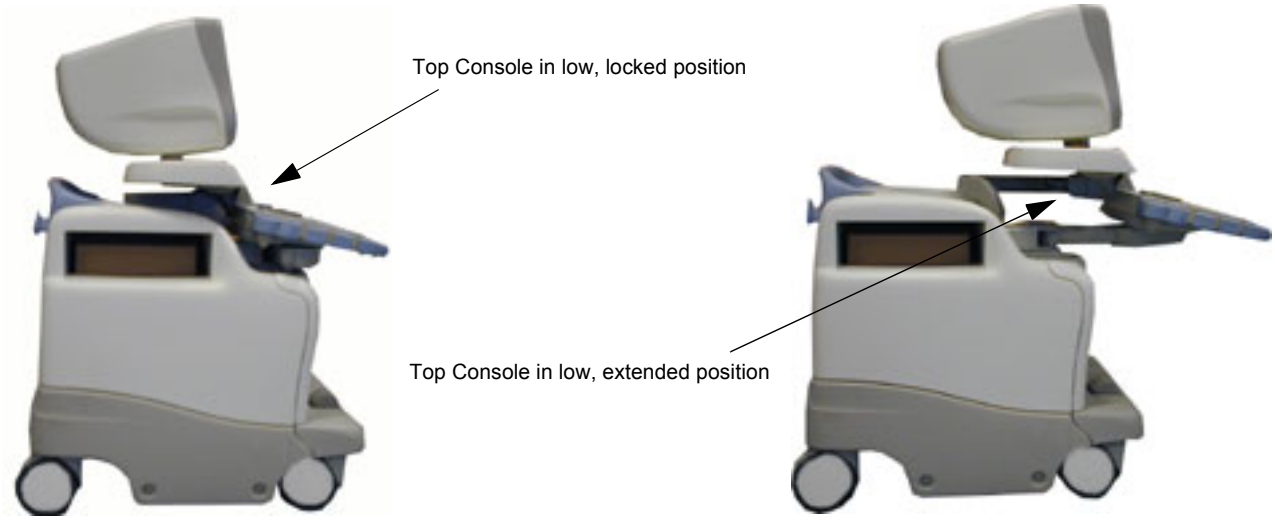




Figure 5-54 Top Console movement, forward and sideward

5-15-4 General Description Vivid 7 PRO

The Top Console includes Monitor, Monitor Shelf, Speakers and Operator Panel. The Console can be moved from side to side. It can be locked in center position by a mechanism located inside the Console. The handle (XY-release Handle) that open for sideway movement, is located in the center lower side of the Front Handle.

The Top Console can also be moved up and down. The handle (Z-release Handle) is located in the left grip of the Front Handle. A gas spring inside the system assists in the Z movement. It is actuated by pulling the Z-release Handle and at the same time lifting up or pushing down the Console with some pressure to assist up/down motion.

A flexible harness of electrical and mechanical wires secures the connection between the Top Console and rest of the System.

5-15-5 Location in the Unit Vivid 7 PRO



Figure 5-55 Vivid 7 PRO - Top Console Movement

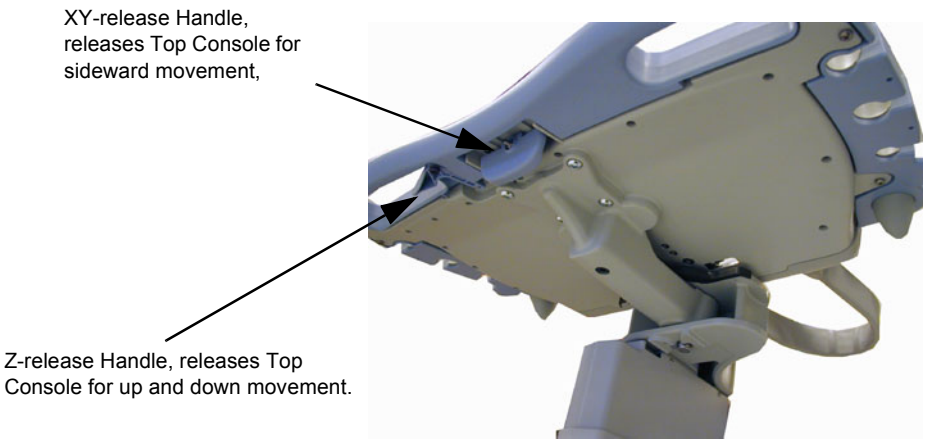

XY-release Handle, releases Top Console for sideward movement,
Z-release Handle, releases Top Console for up and down movement.

Figure 5-56 Vivid 7 PRO Console Swivel Mechanism

Section 5-16
Common Service Platform

5-16-1 Introduction

The Service Platform contains a set of software modules that are common to many of GE's ultrasound and cardiology systems. This web-enabled technology provides linkage to e-Services, e-Commerce, and the iCenter, making GE's scanners more e-enabled than ever.

5-16-2 *iLinq* Interactive Platform Features

Many of the services of the Common Service Platform come from its integration with *iLinq*. The following sections contain a brief introduction of *iLinq's* features.

5-16-2-1 Web Server/Browser

The Service platform and other Service software use the *iLinq* web server and browser.

5-16-2-2 Connectivity

This feature provides basic connectivity between the scanner and the OnLine Center (OLC).

5-16-2-3 Configuration

This feature provides the interfaces to configure various *iLinq* parameters.

5-16-2-4 Contact GE

Allows a one-switch touch for the user to contact the OnLine Center and describe problems with their scanner in an easy and convenient way.

5-16-2-5 Interactive Application

The main application is displayed in the form of HTML pages whenever the browser starts. This is the entry point for any user to start any *iLinq* application.

5-16-3 Global Service User Interface (GSUI)

GSUI is the pattern for the user interface. This interface standard will be followed by all modalities to achieve a common look-and-feel for service software across all GEMS products.

5-16-3-1 Internationalization

The user interfaces provided by the service platform are designed for GE personnel and as such are in English only. At this time there is no multi-lingual capability built into the Common Service Interface.

5-16-3-2 Service Login

Press the switch with the wrench icon () in the status bar at the bottom of the video screen.

This switch links the user or the Field Engineer (FE) to the service login screen.

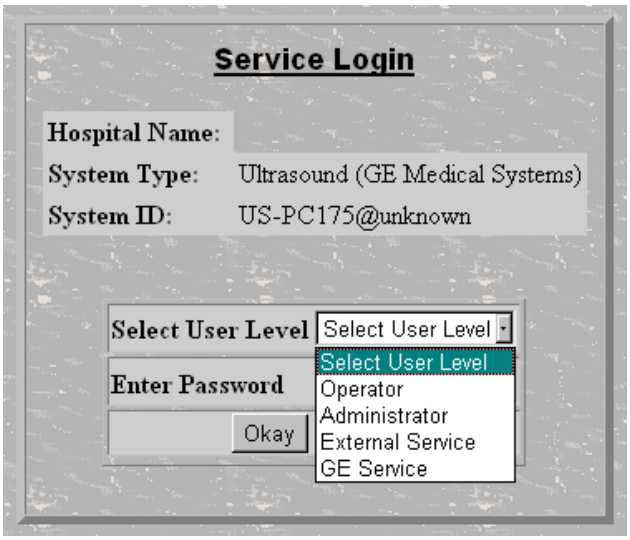


Figure 5-57 Service Login Screen

5-16-3-3 Access / Security

The service interface has different access and security user levels. Users are only granted access to the tools they are authorized to use.

Table 5-77 Access Authorization

User Level	Access Authorization
Operator	These service tools are normally used in-house and are protected with a password.
Administrator	Use the OnLine Center access method provided by *iLinq*.
External Service	Access is protected with a password.
GE Service	Requires knowledge of a password.*

A modem on the scanner is specifically intended for *iLinq* use (by the user) and for InSite use.

Every access request, whether successful or not, will be logged into a service access log that is viewable to authorized users.

See Chapter 7 for more info about InSite and the Global Service User Interface.

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Chapter 6
Service Adjustments

Section 6-1
Overview

6-1-1 Purpose of Chapter 6

This section describes how to adjust the scanner.

Table 6-1 Contents in Chapter 6

Section	Description	Page Number
6-1	Overview	6-1
6-2	Power Supply Adjustments	6-1
6-3	Monitor Adjustments	6-2
6-4	Front End Alignment Procedure	6-3
6-5	Direction Lock and Brake Adjustment	6-4

Section 6-2
Power Supply Adjustments

It is not possible to adjust the power supplies on this unit.

Section 6-3
Monitor Adjustments

6-3-1 Cautions and Warnings

N/A

6-3-2 Access to Adjustments

The adjustments of the monitor is done via controls (buttons) on front of the monitor.

6-3-3 Adjustment Procedure(s)

The display monitor's contrast and brightness controls may need periodic adjustment due to changes in ambient light. They are adjusted from the three buttons on the front part of the display monitor.

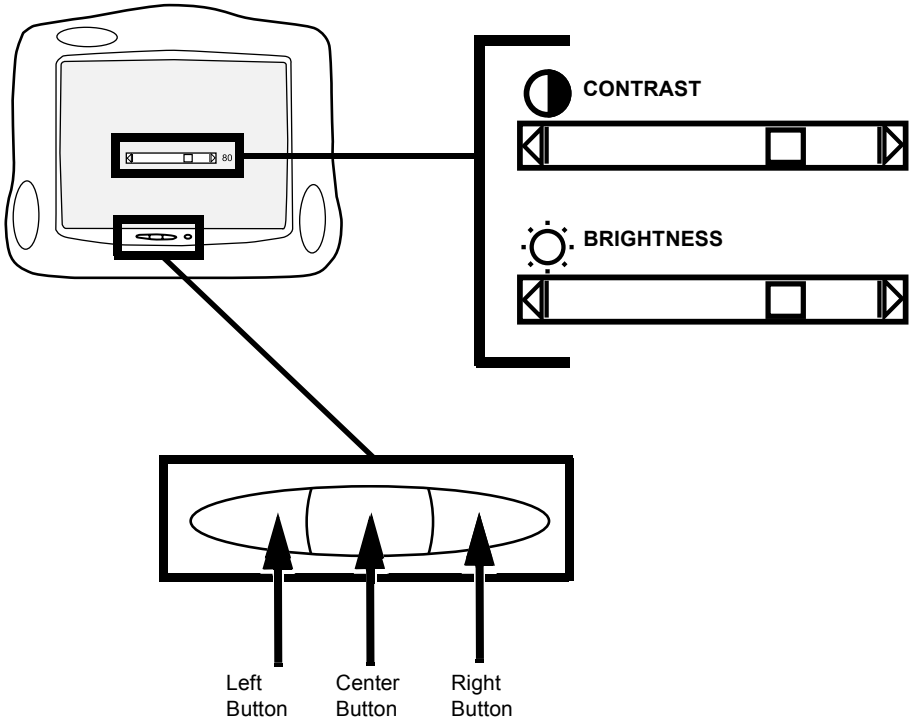


Figure 6-1 Adjust Contrast and Brightness

6-3-3-1 Adjust Contrast

1.) Press Left button on the display monitor once (see *Figure 6-1*).
2.) Press Right button to increase contrast.
3.) Press Center button to decrease contrast.

The amount of contrast is shown on a slider on the screen (see *Figure 6-1*).

6-3-3-2 Adjust Brightness

1.) Press the Left button on the display monitor twice (see *Figure 6-1*).
2.) Press the Right button to increase brightness.
3.) Press the Center button to decrease brightness.

The amount of brightness is shown on a slider on the screen (see *Figure 6-1*).

Section 6-4
Front End Alignment Procedure

6-4-1 Introduction

Front End Alignment Procedure (Beam Former Calibration Procedures) are performed to calibrate each ADC channel of the two Bean Former (BF) inputs. The system calibrates the ADC to zero output when there is no signal on the input. These bias voltages are stored in Backend Processor.

6-4-2 When to do a Front End Alignment Procedure

Do the Front End Alignment procedure;

- when installing a new Vivid 7 / Vivid 7 PRO
- after software has been updated or replaced
- when BF boards have been interchanged
- when a BF board has been replaced
- when the Backend Processor has been replaced

6-4-3 Procedure

See 7-4-5 - Beamformer Calibration (Front End Alignment) starting on page 7-65.

Section 6-5
Direction Lock and Brake Adjustment

6-5-1 Front Caster Brakes Adjustment Procedure

6-5-1-1 Manpower

2 persons

6-5-1-2 Tools

- Hexagon key 3/32” inch
- Phillips screw driver size 2

6-5-1-3 Preparations

1.) Set Rear Brakes to prevent system from rolling.
2.) Remove Front Bumper as described in "Front Bumper Removal Procedure" on page 8-50.

6-5-1-4 Front Caster Brakes Adjustment

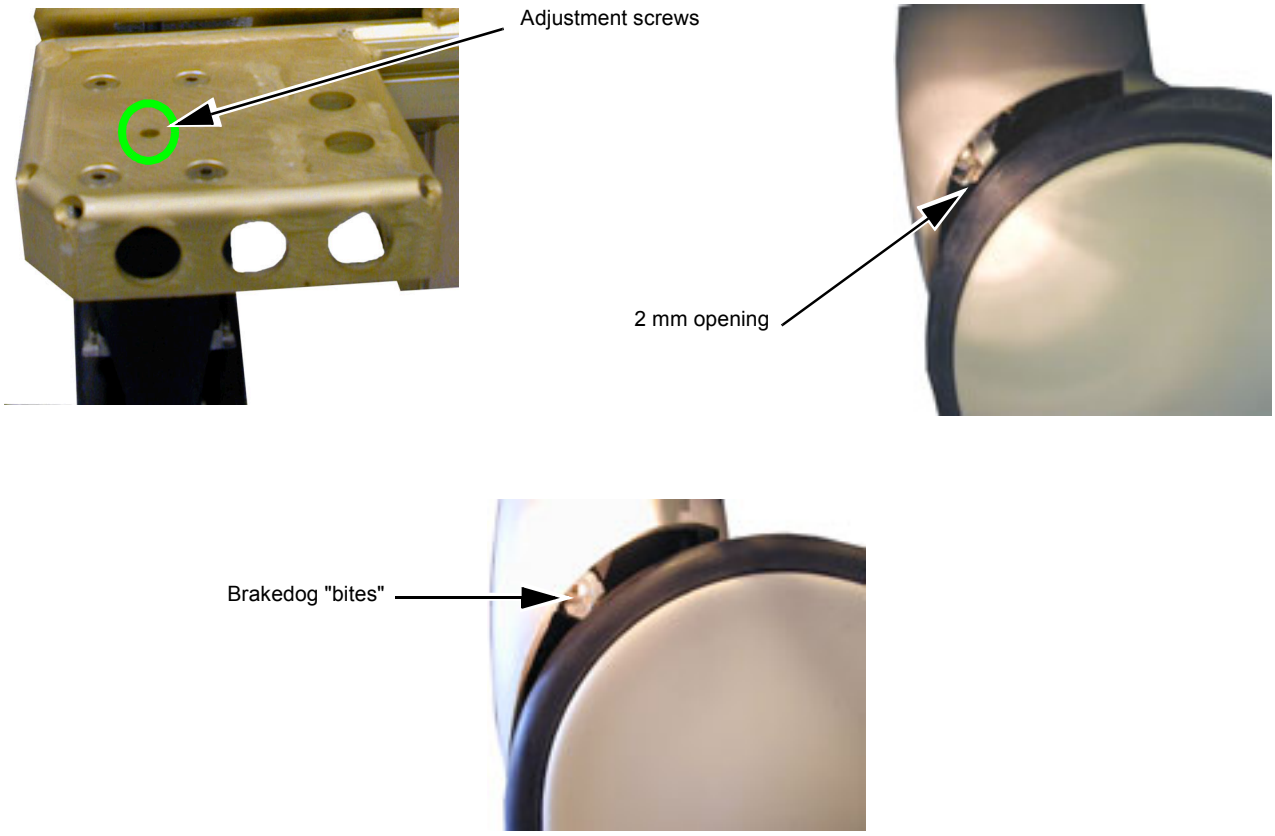


Figure 6-2 Front Brakes adjustment

1.) Use a hexagon key, and screw the adjustment screw until the opening between brake dogs and tires are approximate 2 mm.
2.) Install Front Bumper as described in "Front Bumper Installation Procedure" on page 8-50.
3.) Test Front Brakes.

6-5-2 Direction Lock Adjustment Procedure

6-5-2-1 Manpower

1 person, 30 minutes

6-5-2-2 Tools

Open end wrench, 13 mm

6-5-2-3 Preparations

1.) Block Rear Casters.
2.) Push down Direction Lock Pedal.
3.) Turn Casters until they locks in forward pointing position.

6-5-2-4 Direction Lock Adjustment

1.) Loosen the retaining nuts on the brake rods on both Front Casters to allow room for adjustment.
2.) Remove the lock pins that secures the balljoints (See Figure 6-3).
3.) Pull balljoints apart.

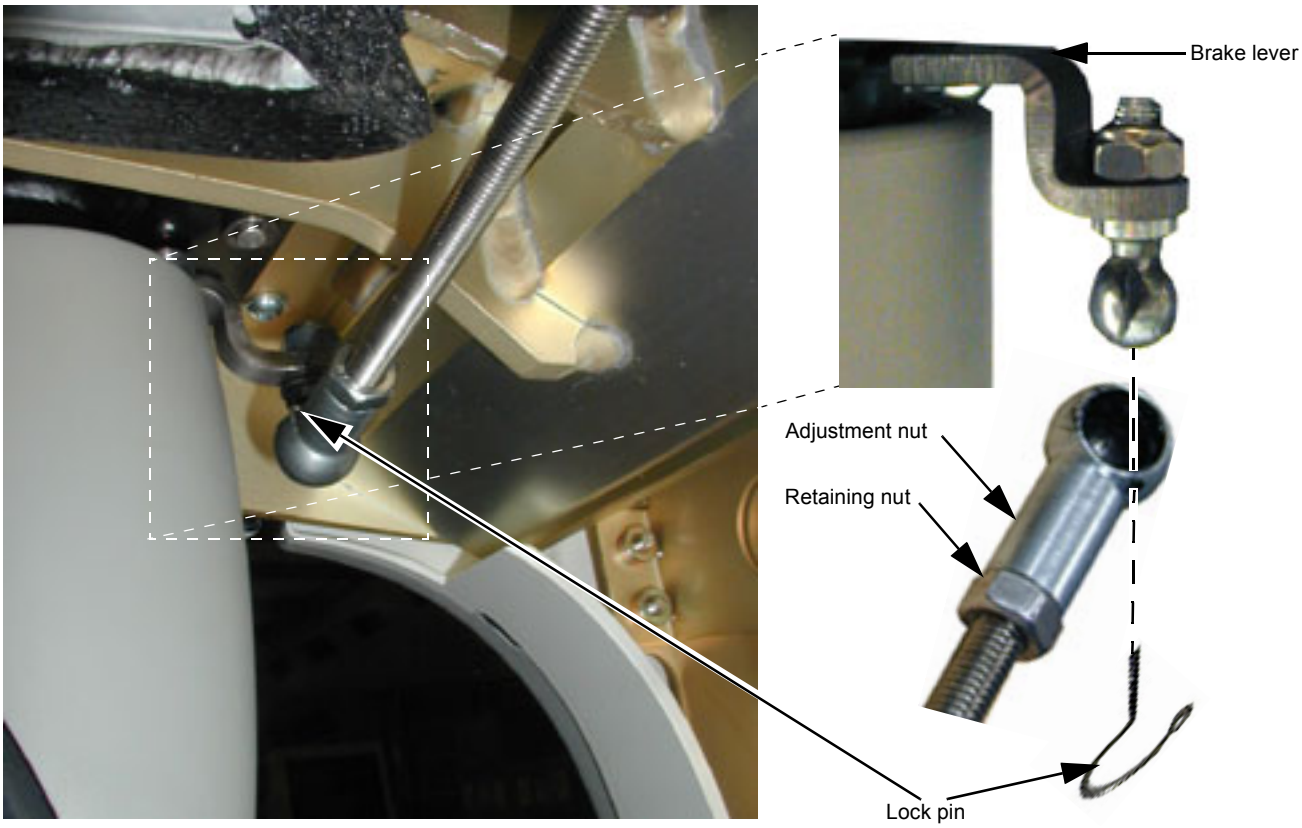


Figure 6-3 Front Caster Brake Arm and Ball Joint Parts

4.) Each part of the separated balljoint shall match each other when the brake lever on the Casters are in direction lock position, which is in left position on both Casters.

6-5-2-4 Direction Lock Adjustment (cont'd)

5.) Turn adjustment nuts until the balljoints matches.

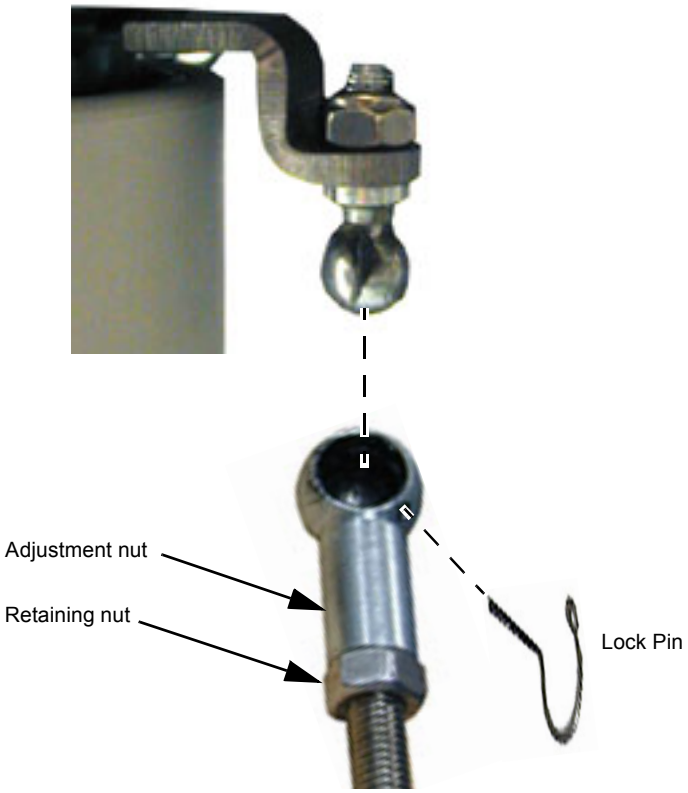


Figure 6-4 Balljoint with Lock Pin

6.) Press the balljoint together.
7.) Install the lock pins, see Figure 6-3.
8.) Fasten the retaining nuts.
9.) Test Direction Lock.

6-5-3 Rear Brakes Adjustment

6-5-3-1 Manpower

2 persons, 1 hour

6-5-3-2 Tools

- Hexagon key 3/32 inch
- Phillips screw driver size 2

6-5-3-3 Preparations

1.) Remove Filter Cover as described in "Filter Cover Removal Procedure" on page 8-6.
2.) Remove Lower Rear Cover as described in "Lower Rear Cover Removal Procedure" on page 8-8.
3.) Remove the Caster as described in "Rear Casters Removal Procedure" on page 8-41

6-5-3-4 Rear Brakes Adjustment

1.) Use a 3/32 inch hexagon key to adjust the brake until the space between brakedogs and tires are approximate 2 mm.



Figure 6-5 Rear Brakes adjustment

1.) Replace the Caster and tightly fasten it with four screws.
2.) Install Lower Rear Cover as described in "Lower Rear Cover Installation Procedure" on page 8-8.
3.) Install Filter Cover as described in "Filter Cover Installation Procedure" on page 8-6.

⚠ **WARNING** ***Use extreme caution in the next two steps. The scanner will be unstable.***

4.) Remove the Wooden Wedge.
5.) Roll the system off the Bevel Edged Board.

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Chapter 7
Diagnostics/Troubleshooting

Section 7-1
Overview

7-1-1 Purpose of Chapter 7

This section describes how to setup and run the tools and software that help maintain image quality and system operation. Very basic host, system and board level diagnostics are run whenever power is applied. Some Service Tools may be run at the application level.

Table 7-1 Contents in Chapter 7

Section	Description	Page Number
7-1	Overview	7-1
7-2	Diagnostics	7-3
7-3	Common Diagnostics	7-44
7-4	Acquisition Diagnostics	7-59
7-5	Troubleshooting	7-67

7-1-2 Service Software Tools

Two major Service Software tools are available;

- **Global Service User Interface with Common Diagnostics**

  This software tool makes it possible for you to do tests on various functions on the Backend Processor. It also includes an acquisition test that tests most of the PCBs in the Front End Rack. If this test fails, detailed Acquisition Diagnostics tests are available via Vivid 7 / Vivid 7 PRO's software menus.

- **Acquisition Diagnostics**

  This software tool includes detailed Acquisition Diagnostics tests available via Vivid 7 / Vivid 7 PRO's software menus. It is running on the Backend Processor too. It includes both a Test All function that is the same test as available from the GSUI, but also tests on PCB level.

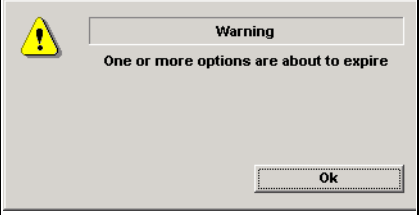
7-1-3 Special Service Tool

- Test Attenuator, PN: AA200215

7-1-4 Frequently Asked Questions

7-1-4-1 Error Message(s) During Start Up

Table 7-2 Error Message(s) During Start Up

Error Message	Description	What to Do
	This message, displayed when starting Vivid 7 / Vivid 7 PRO, indicates that one or more of the installed options soon will expire. Typically, this will be the case when a demo option is about to expire.	If you want to keep the option(s) active, it is time to order the option(s) now. Contact your GE sales representative for more details. If you don't need the option(s), you can ignore this message. You must click OK to continue the start up of Vivid 7 / Vivid 7 PRO.
	This message indicates that all of the installed options have expired. Typically, this will be the case when all demo options have expired.	Contact your GE sales representative for more details.

Section 7-2
Diagnostics

7-2-1 Diagnostic Procedure Summary

Two software based diagnostics tools are available on Vivid 7 / Vivid 7 PRO;

- Global Service User Interface (GSUI) and
- Vivid 7 / Vivid 7 PRO's Front End System Test

To be able to use these Service Tools, the Backend Processor must be up and running to some extent. If the Backend Processor doesn't starts, it's not possible to use the software service tools!

A typical approach would be to first log on to the GSUI and run the tests there. If the Acquisition test fails, it is time to switch to Vivid 7 / Vivid 7 PRO's Front End System Test.

7-2-1-1 List of Service Tools Available via GSUI

Table 7-3 List of Service Tools Available via GSUI

Software Tool	Description	Operator	Administrator	External Service	Page Number
Error logs	Vivid 7 / Vivid 7 PRO Error Logs	x	x	x	7-7
Diagnostics	Vivid 7 / Vivid 7 PRO Diagnostics	x	x	x	7-23
Image Quality	[Not Populated]	-	-	-	7-28
Calibration	[Not Populated]	-	-	-	7-29
Configuration	[Not Populated]	-	-	-	7-31
Utilities	Vivid 7 / Vivid 7 PRO Service Utilities	x	x	x	7-32
Replacement	[Not Populated]	-	-	-	7-42
PM	[Not Populated]	-	-	-	7-43

7-2-2 Common Service Diagnostic Interface (Ultrasound Interface)

7-2-2-1 Connect PC to the Ultrasound Unit

It is not necessary to connect a PC to Vivid 7 / Vivid 7 PRO to use the GSUI.

7-2-2-2 Log-in to GSUI

Double-click the button with the wrench icon () in the status bar at the bottom of the video screen. This button links the user or the Field Engineer (FE) to the Service Login Screen.

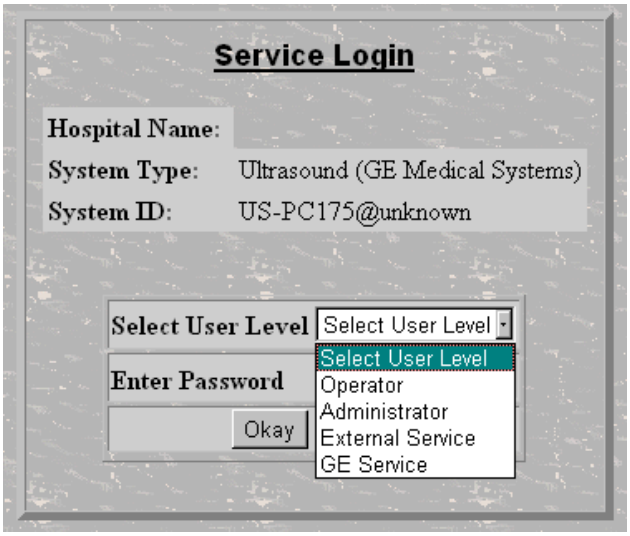


Figure 7-1 Service Login Screen

Log on as *External Service* with password: *gogems* (all lowercase letters).

7-2-3 Service Home Page

When the Common Service Desktop is started, the Service Home Page appears. The Home Page contains System Location, System IP Address and Application Status. The navigation bar at the top of the screen allows the user to select from several tools and applications.

*NOTE: When using the Common Service Desktop do **NOT** iconify any of the Common Service Desktop windows. If you iconify them they end up in the lower left-hand corner of the screen behind the Service Desktop Manager window and cannot be restored.*

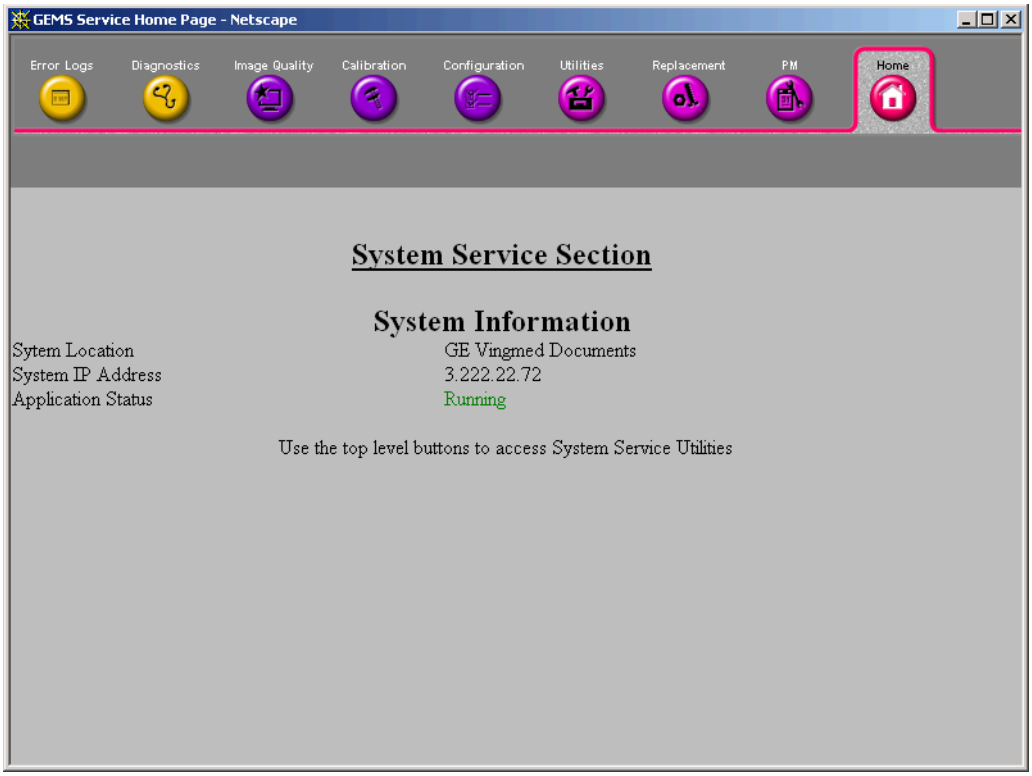


Figure 7-2 Service Interface Home Page

7-2-3-1 Menu Bar Description

On top of the Service Interface Home Page, there is a Menu Bar where you can choose between these screens, see Figure 7-3;

- Error Logs
- Diagnostics
- Image Quality
- Calibration
- Configuration
- Utilities
- Replacement
- PM
- Home

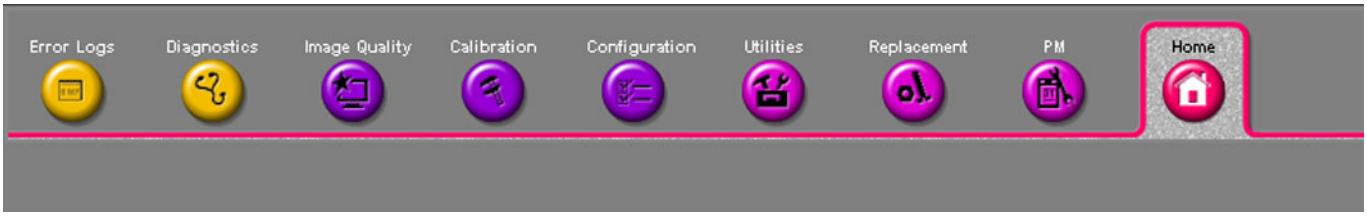


Figure 7-3 Service Interface Home Page

Click an icon to open the respective screen.

7-2-4 Description of Screens

Each screen may include one or more "sub-screens". The next sections describes the different screens available.

7-2-5 Error Logs

From the Error Logs page the Log Viewer displays five categories with pull-down sub-menus.

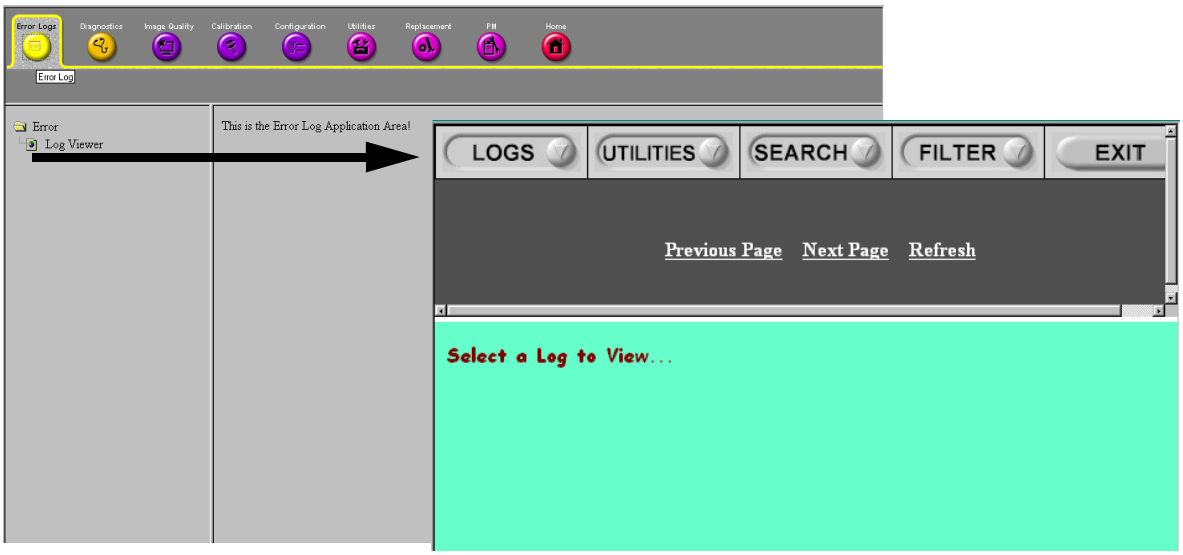


Figure 7-4 Error Log Viewer Menu

7-2-5-1 Logs

The sub-menus of the Logs category are System, Power, Informatics, Temperature, Probe, Board, DICOM and DCPower.

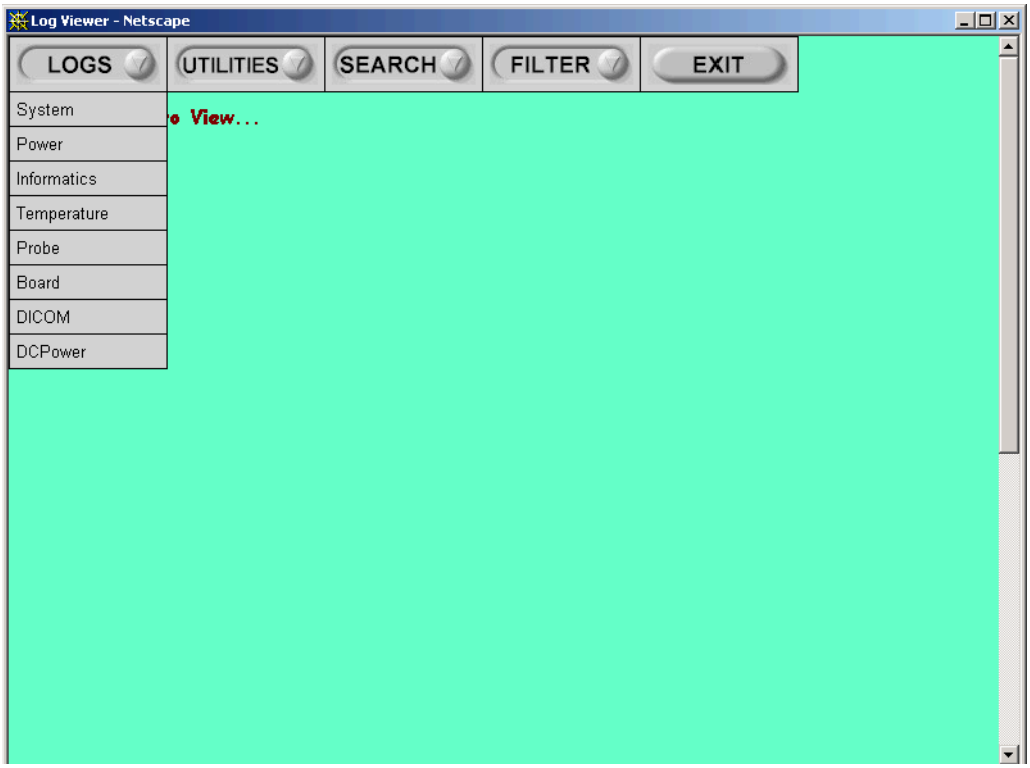


Figure 7-5 Logs Submenu

7-2-5-2 System

Select this screen to view System log. It displays all error messages from Vivid 7 / Vivid 7 PRO.

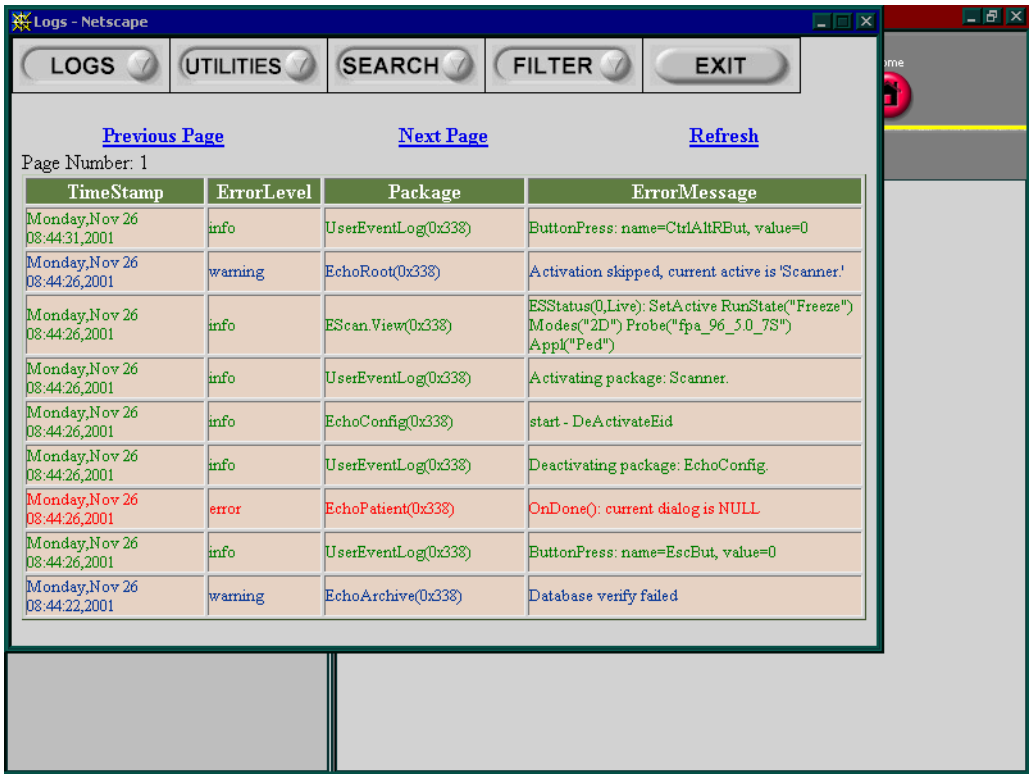


Figure 7-6 Example of System Error Log

7-2-5-3 Power

Select this screen to view Power log.

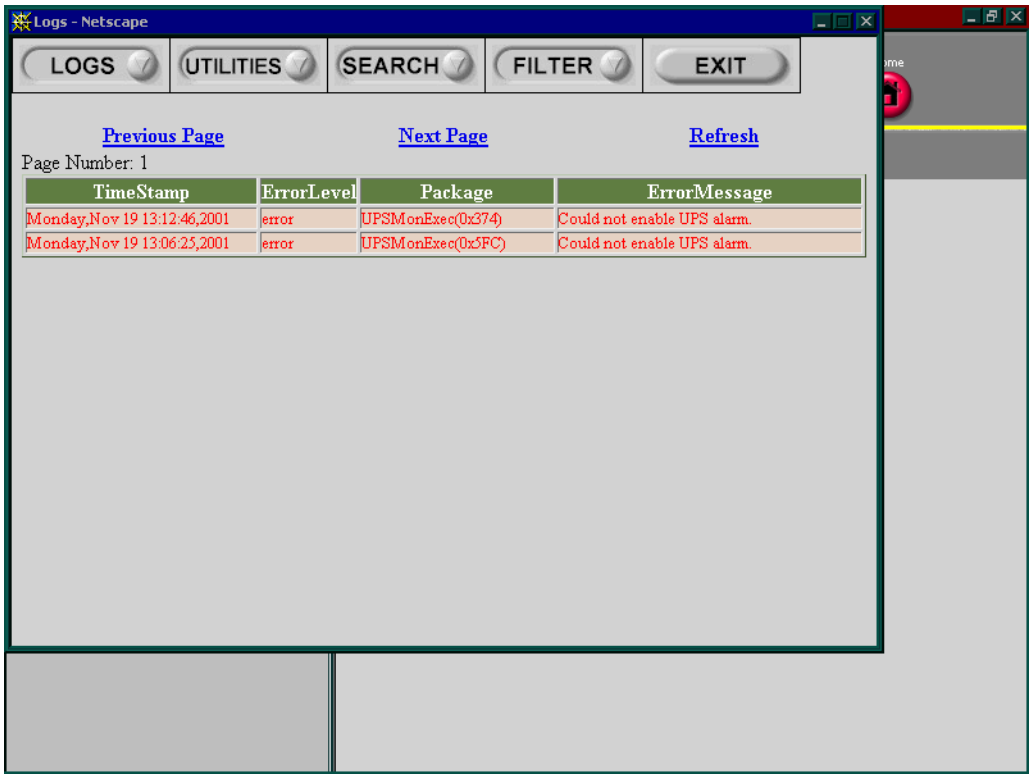


Figure 7-7 Example of Power Log

7-2-5-4 Informatics

Select this screen to view Informatics log.

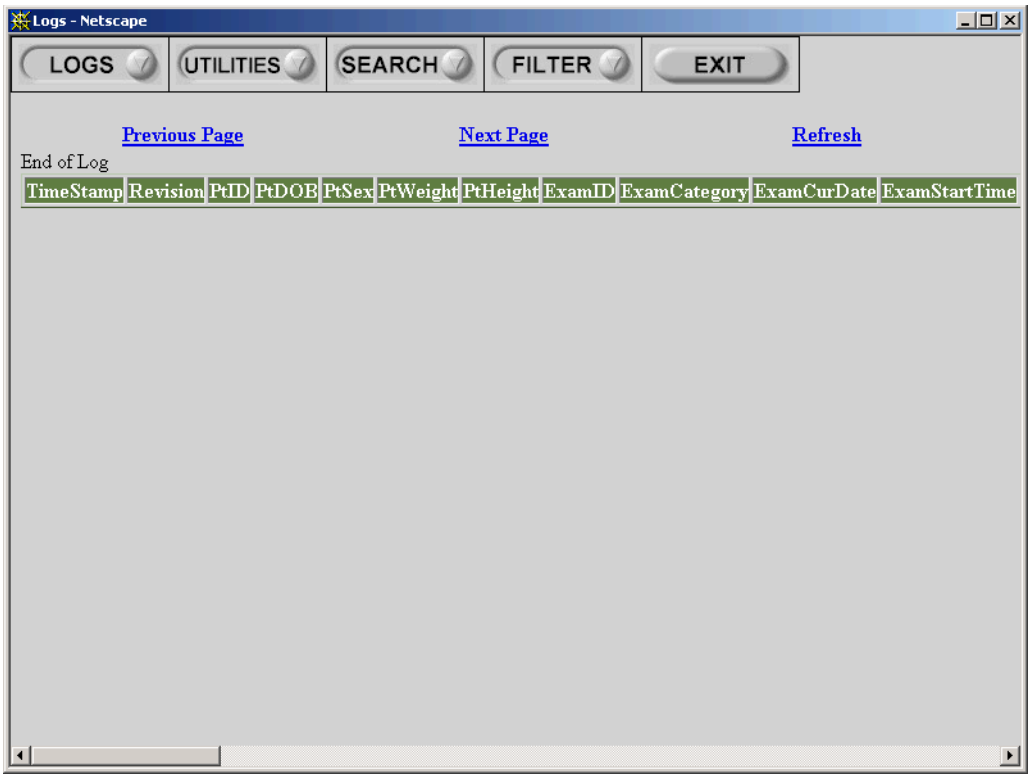
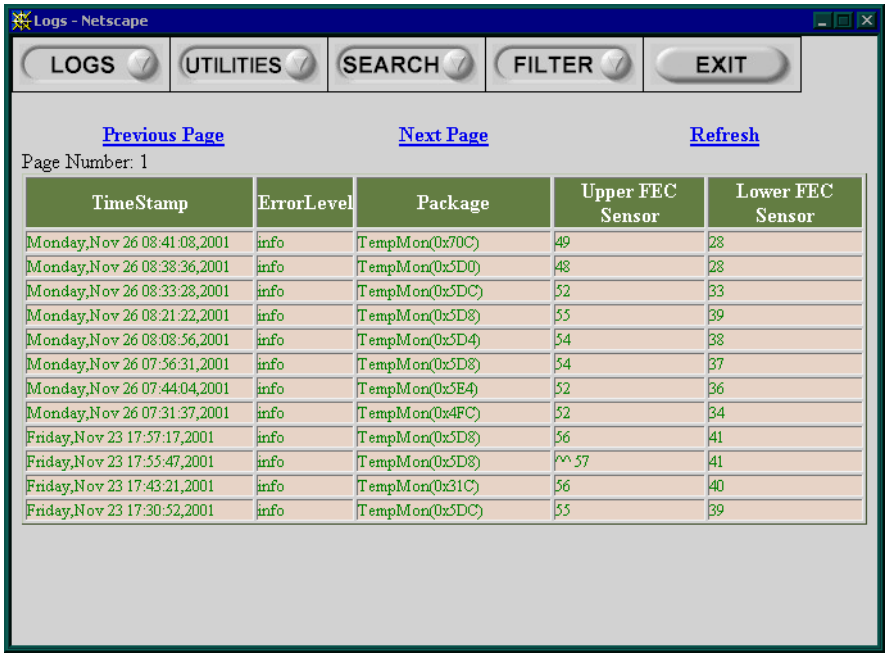


Figure 7-8 Example of Informatics Log

7-2-5-5 Temperature

Select this screen to view Temperature Log



TimeStamp	ErrorLevel	Package	Upper FEC Sensor	Lower FEC Sensor
Monday,Nov 26 08:41:08,2001	info	TempMon(0x70C)	49	28
Monday,Nov 26 08:38:36,2001	info	TempMon(0x5D0)	48	28
Monday,Nov 26 08:33:28,2001	info	TempMon(0x5DC)	52	33
Monday,Nov 26 08:21:22,2001	info	TempMon(0x5D8)	55	39
Monday,Nov 26 08:08:56,2001	info	TempMon(0x5D4)	54	38
Monday,Nov 26 07:56:31,2001	info	TempMon(0x5D8)	54	37
Monday,Nov 26 07:44:04,2001	info	TempMon(0x5E4)	52	36
Monday,Nov 26 07:31:37,2001	info	TempMon(0x4FC)	52	34
Friday,Nov 23 17:57:17,2001	info	TempMon(0x5D8)	56	41
Friday,Nov 23 17:55:47,2001	info	TempMon(0x5D8)	57	41
Friday,Nov 23 17:43:21,2001	info	TempMon(0x31C)	56	40
Friday,Nov 23 17:30:52,2001	info	TempMon(0x5DC)	55	39

Figure 7-9 Example of Temperature Log

7-2-5-6 Probe

Select this screen to view Probe Log.



TimeStamp	ErrorLevel	Package	Error Message	Severity	Revision	NewLabel1	NewLabel2	NewLab
Monday,Nov 26 08:40:58,2001	info	ProbeLog(0x338)	7S	2	2251903	149	00	0
Monday,Nov 26 08:40:58,2001	info	ProbeLog(0x338)	7S	1	2251903	149	00	0
Monday,Nov 26 08:38:26,2001	info	ProbeLog(0x4AC)	7S	2	2251903	149	00	0
Monday,Nov 26 08:38:26,2001	info	ProbeLog(0x4AC)	7S	1	2251903	149	00	0
Monday,Nov 26 08:33:18,2001	info	ProbeLog(0x4B4)	7S	2	2251903	149	00	0
Monday,Nov 26 08:33:18,2001	info	ProbeLog(0x4B4)	7S	1	2251903	149	00	0
Monday,Nov 26	info	ProbeLog(0x4AC)	7S	2	2251903	149	00	0

Figure 7-10 Example of Probe Log

7-2-5-7 Board

Select this screen to view Board log.

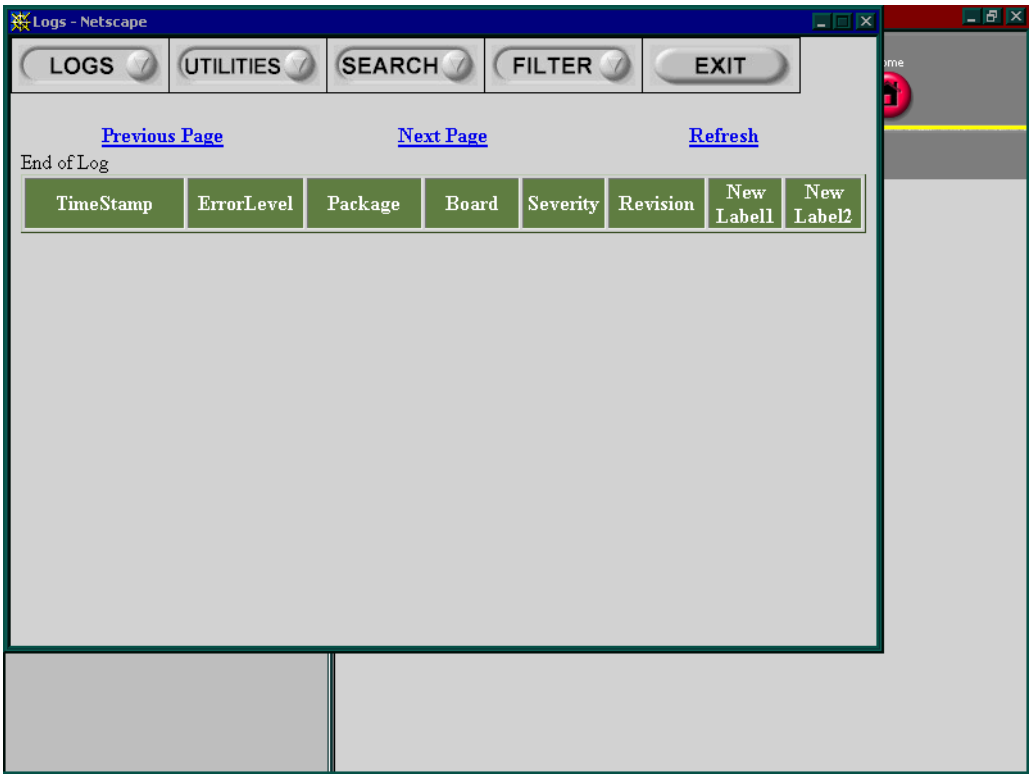


Figure 7-11 Example of Board Log

7-2-5-8 DICOM

Select this screen to view DICOM log.

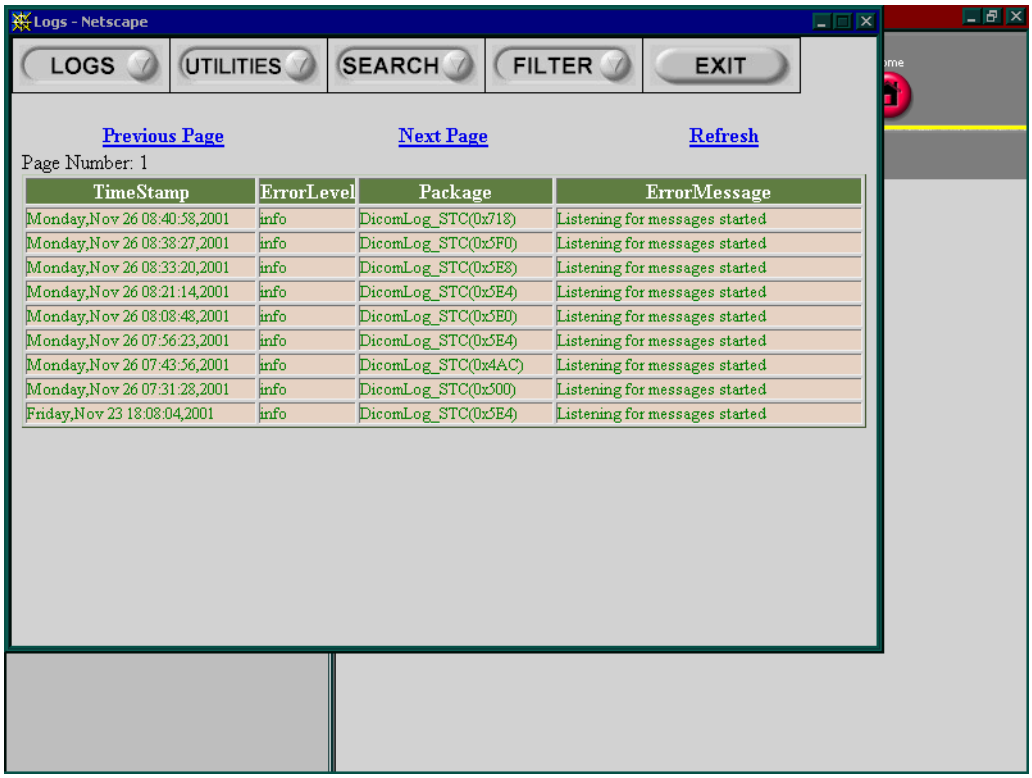

Logs - Netscape
LOGS
UTILITIES
SEARCH
FILTER
EXIT
Previous Page
Next Page
Refresh
Page Number: 1
TimeStamp
ErrorLevel
Package
ErrorMessage
Monday,Nov 26 08:40:58,2001 info DicomLog_STC(0x718) Listening for messages started
Monday,Nov 26 08:38:27,2001 info DicomLog_STC(0x5F0) Listening for messages started
Monday,Nov 26 08:33:20,2001 info DicomLog_STC(0x5E8) Listening for messages started
Monday,Nov 26 08:21:14,2001 info DicomLog_STC(0x5E4) Listening for messages started
Monday,Nov 26 08:08:48,2001 info DicomLog_STC(0x5E0) Listening for messages started
Monday,Nov 26 07:56:23,2001 info DicomLog_STC(0x5E4) Listening for messages started
Monday,Nov 26 07:43:56,2001 info DicomLog_STC(0x4AC) Listening for messages started
Monday,Nov 26 07:31:28,2001 info DicomLog_STC(0x500) Listening for messages started
Friday,Nov 23 18:08:04,2001 info DicomLog_STC(0x5E4) Listening for messages started

Figure 7-12 Example of DICOM Log

7-2-5-9 DCPower

Select this screen to view DCPower Log Screen.

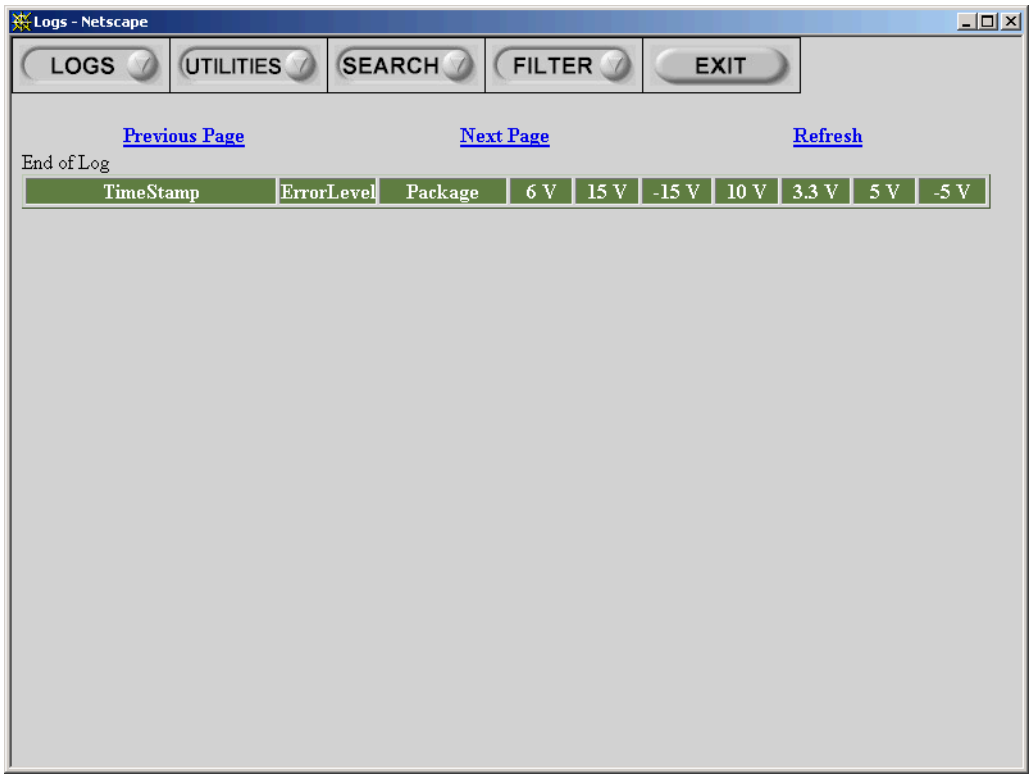


Figure 7-13 Example of DCPower Log Screen

7-2-6 Utilities

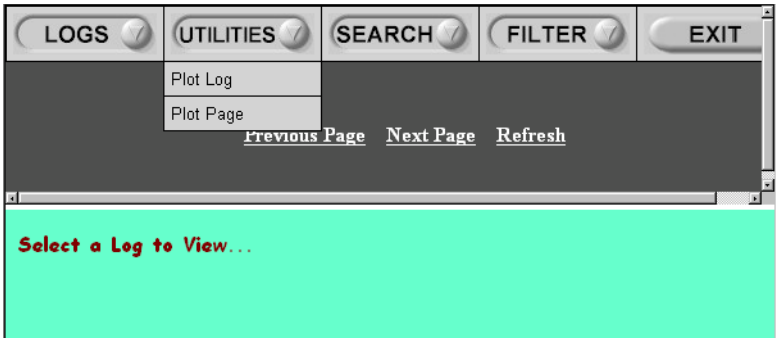


Figure 7-14 Utilities Category

7-2-6-1 Plot Log

Select *Plot Log* to make a plot of the active log on screen.

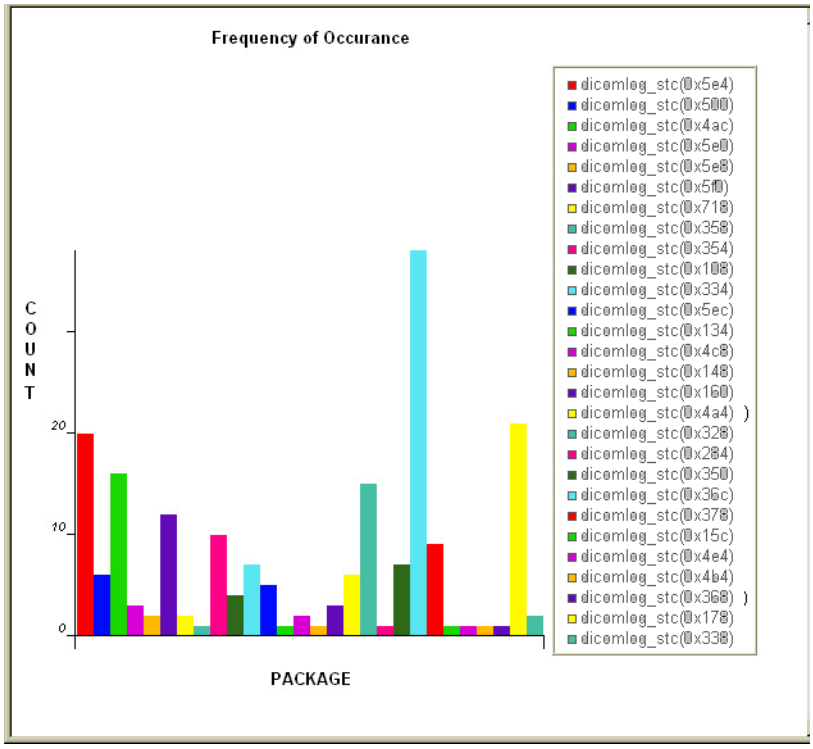


Figure 7-15 Utilities, Plot Log (example)

7-2-6-2 Plot Page

Select *Plot Page* to make a plot of the active (log-) page on screen.

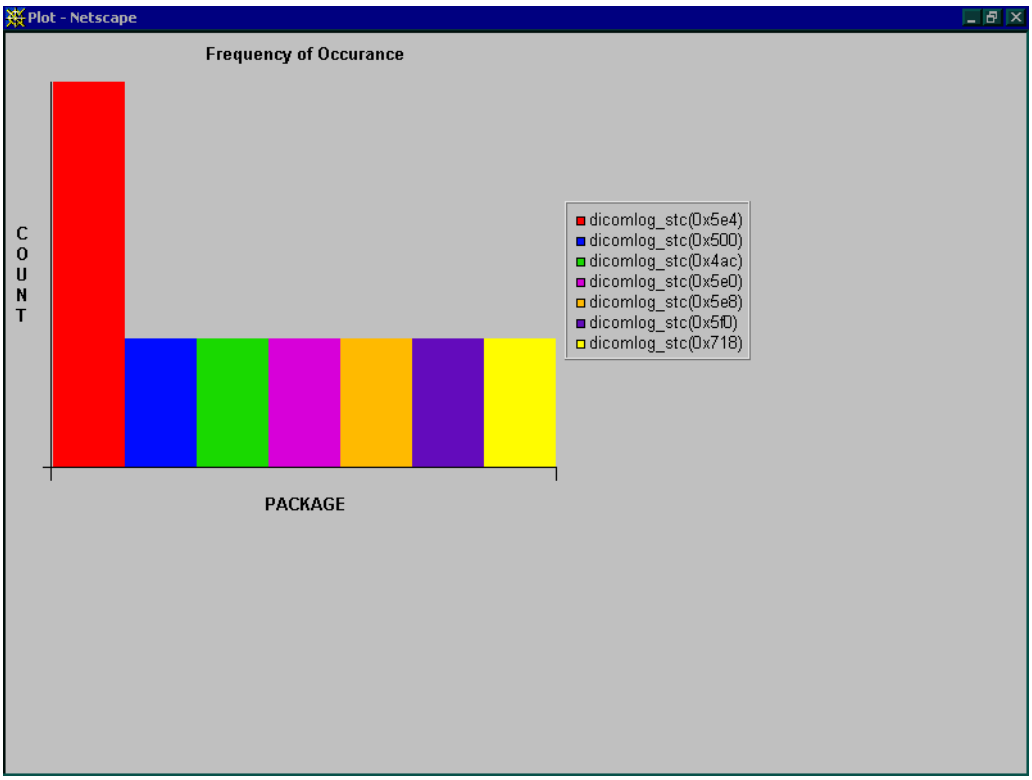


Figure 7-16 Utilities, Plot Page (example)

7-2-6-3 Search

On the Text Search sub-menu of the Search category, users enter case-sensitive text they wish to search for in the logs.

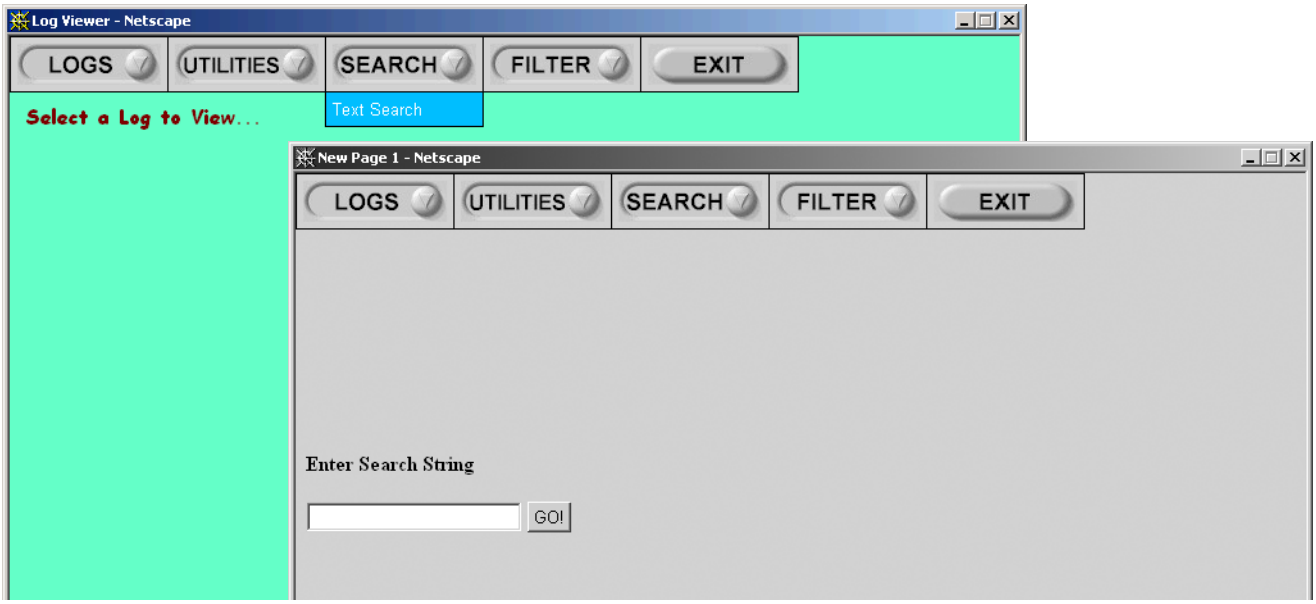


Figure 7-17 Search Category

7-2-6-4 Filter

This function is available for GE Service only.

7-2-6-5 Exit

The sub-menu, Exit Log Viewer, returns the user to the Common Service Desktop Home Page.

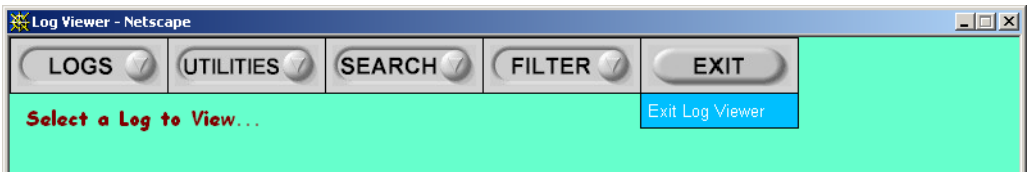


Figure 7-18 Exit Log Viewer Category

7-2-7 Diagnostics

When the Diagnostics Screen has been selected, two main tools are available;

- Acquisition Diagnostics
- Common Diagnostics, *See "Common Diagnostics" on page 7-44.*

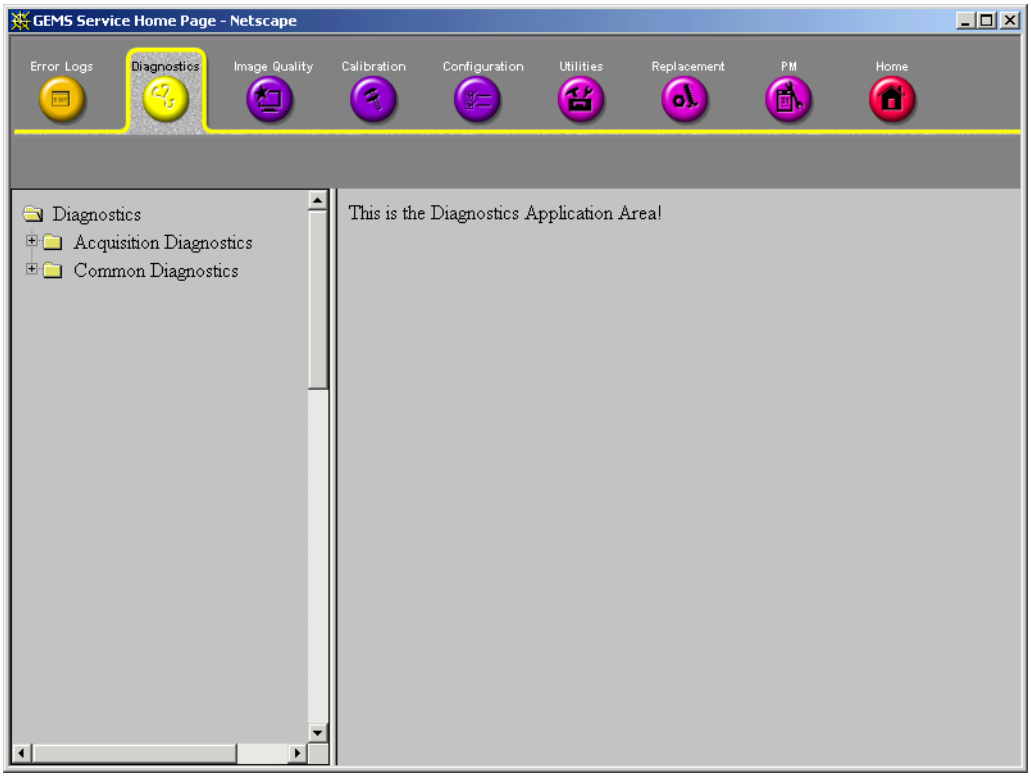


Figure 7-19 Diagnostics Screen Home Page

7-2-7-1 Acquisition Diagnostics-Test All

One test is available, *Test All.*

Test All runs a sequential test of the following;

1.) PC2IP
2.) IMP (Image Port Board)
3.) VME (VME data bus on the Back Plane)
4.) SDP (Spectrum Doppler Processor)
5.) RFT (Radio Frequency & Tissue Board)
6.) FEC (Front End Controller Board) (Some parts of TX board is also tested)
7.) BF (Beam Former Boards)
8.) RX (Receiver Board)
9.) TXP (TX Power)

NOTE: Relay Board (RLB) and Chain are not tested in this test. Some parts of the Transmitter (TX) Board is tested during the FEC Board test, but other parts of the TX Board are not tested at all.

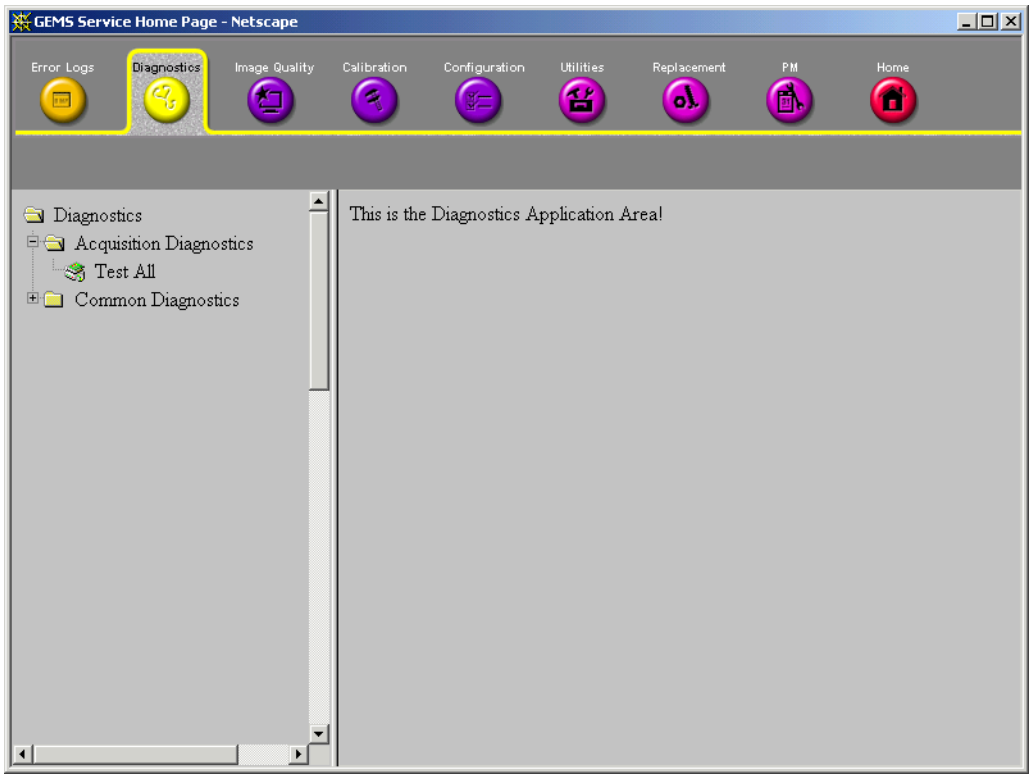


Figure 7-20 User Interface Diagnostic Screen, Test All

7-2-7-2 Instructions Frame

Displays a test-specific page or the default instructions page.

7-2-7-3 Status Frame

Initially displays the last known status for the particular diagnostic. Once the diagnostic starts, the frame displays the “current” status of all test results.

7-2-7-4 Control Frame

Contains the user interface elements used for:

- Diagnostic control
- Operator feedback

a.) Execute Button

This button has two modes - each with appropriate text:

* Execute - to start the diagnostic, and
* Abort - to stop a diagnostic

b.) Loop Count

This is an editable text field that will only accept numeric values with 4 digits or less. When the button described in *Execute Button step a* (above) is configured as an “execute” button and pressed, the loop count field will be queried to determine the number of times to execute the diagnostic.

c.) Progress Indicator

Displays a graphical progress indicator for the user.

d.) Short Text Message

Displays either a starting message or aborting message, as well as the diagnostic completion status.

e.) Control Frame Background Color

Initially gray, the Control Frame background color changes upon completion of a diagnostic to indicate completion status.

* Fail = Red
* Pass = Green

7-2-7-4 Control Frame (cont'd)

Examine the log in the status frame to find the test(s) that failed. (In the example in Figure 7-21, all the tests failed.)

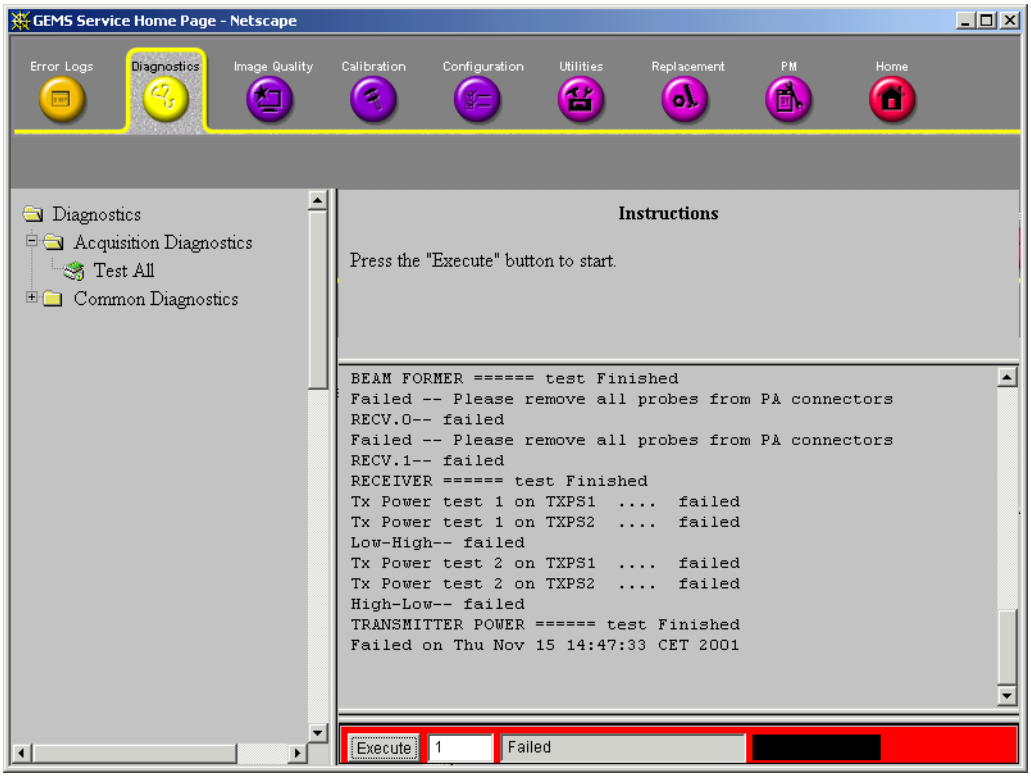


Figure 7-21 User Interface Diagnostic Screen, *Test All* Failed

7-2-7-4 Control Frame (cont'd)

In Figure 7-22, the test passed. The green background color in the Control Frame indicates that the test passed.

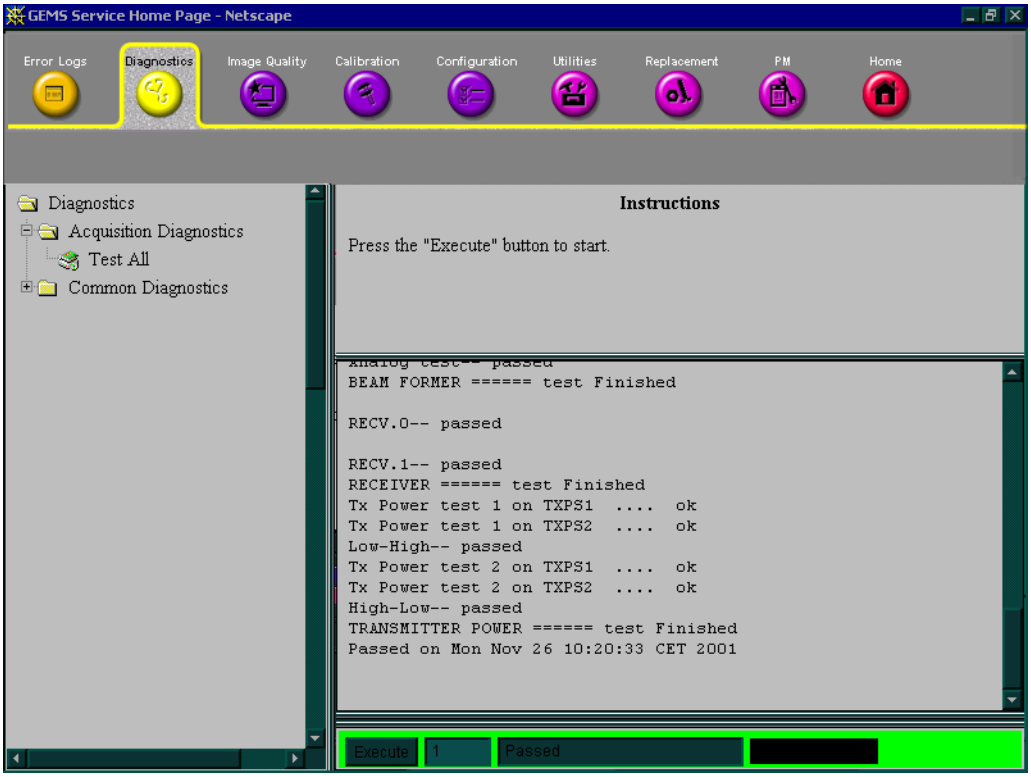


Figure 7-22 User Interface Diagnostic Screen, *Test All* Passed

7-2-7-5 Common Diagnostics

See "Common Diagnostics" on page 7-44.

7-2-8 Image Quality

Field is not populated.

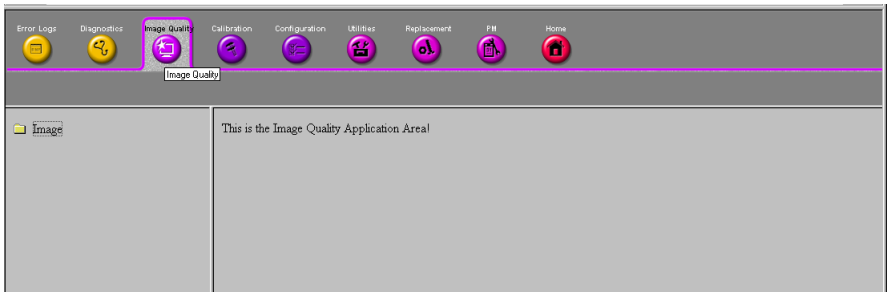


Figure 7-23 Image Quality Page

7-2-9 Calibration

This screen gives you access to:

- DC Offset calibration
- Reset DC-Offset cal

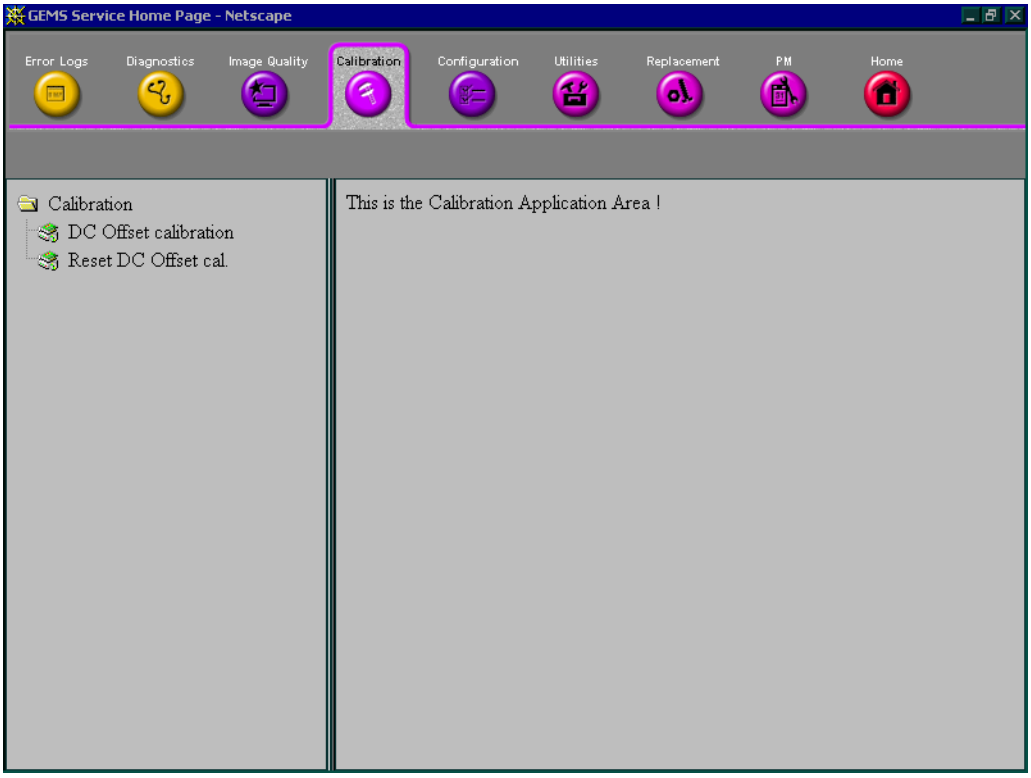


Figure 7-24 Calibration

7-2-9-1 DC Offset calibration

DC Offset calibration also called “Beamformer Calibration” or "Frontend Alignment" is performed to calibrate each ADC channel of the two Beam Former (BF) board inputs. The system calibrates the Beamformer ADCs to zero output when there is no signal on the input.

These bias voltages are stored on hard disk in Backend Processor.

7-2-9-2 Setup

Disconnect all probes before starting the calibration.

7-2-9-3 When to Use this Procedure

This procedure should be performed;

- when installing a new Vivid 7 / Vivid 7 PRO
- after software has been updated or replaced
- when BF boards have been interchanged
- when a BF board has been replaced
- when the Backend Processor has been replaced

7-2-9-4 DC Offset Calibration Procedure

1.) Disconnect all connected probes.

2.) Select *DC Offset calibration* and then click the EXECUTE button to start the DC Offset calibration of the Beam Formers.

3.) Wait for the calibration to take place. When finished, restart Vivid 7 / Vivid 7 PRO.

7-2-10 Configuration

Use the Configuration Screen to add or edit Software Options Strings, alphanumeric strings to enable Software Options (the password(s) used for enablingen optional functions).

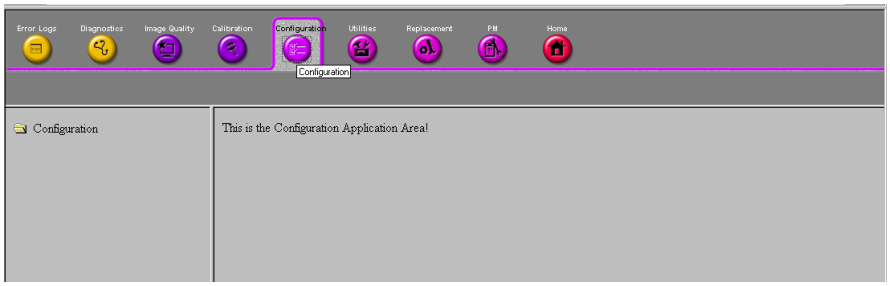


Figure 7-25 Configuration Page

7-2-11 Utilities

The Utilities page contains several miscellaneous tools:

- **Windows 2000 Utilities**
  - Disk Usage
  - IP Configuration
  - Network Status
  - Windows 2000 Services
  - User Accounts
  - Shared Resources
  - System Shutdown
  - Disk Defragmenter
- **Scanner Utilities**
  - System Shutdown
  - Set Debug Utility
  - Reset Database
  - Clean Userdefs
  - Resource File Utility
- **iLink Configuration Utility**
- **ProDiags Configuration Utility**

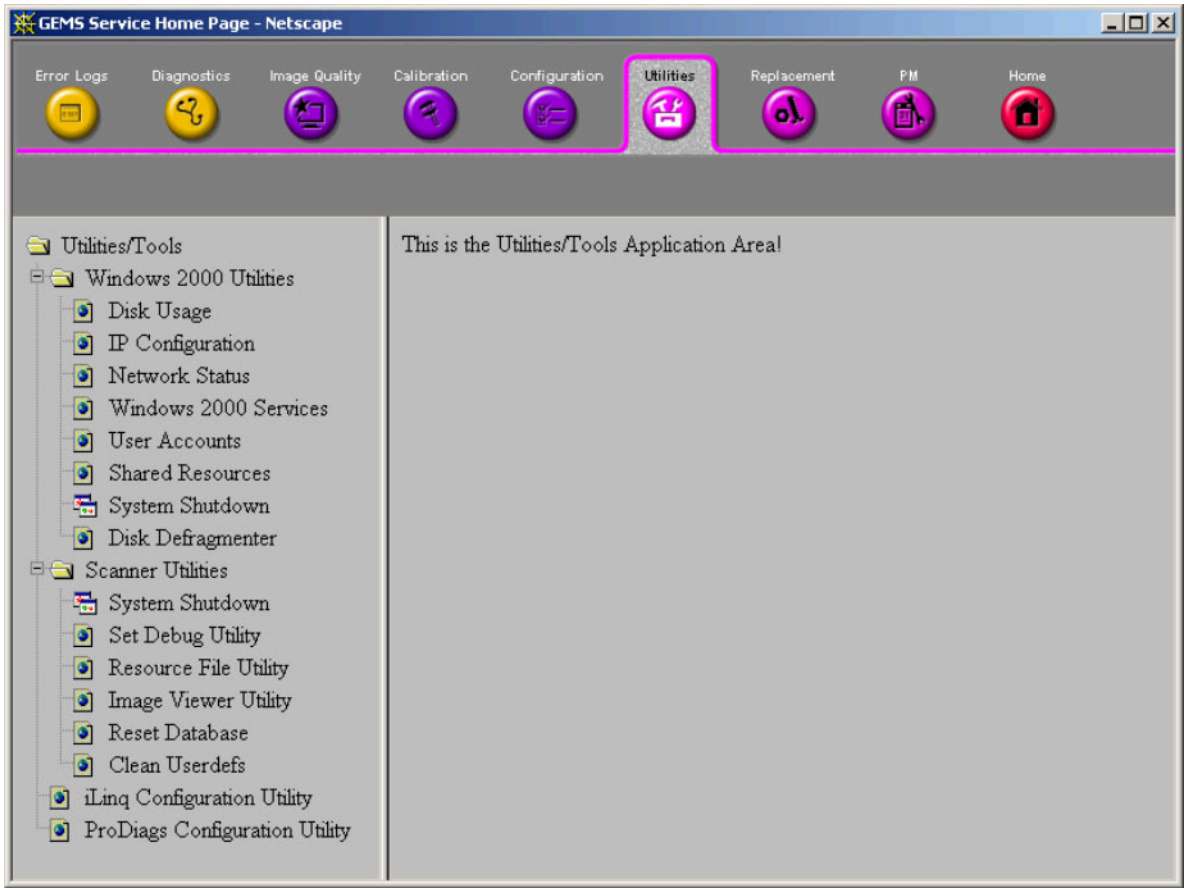


Figure 7-26 Utilities/Tools Page (example)

7-2-11-1 Windows 2000 Utilities

1.) Disk Usage

The Disk Usage page displays an overview of Vivid 7 / Vivid 7 PRO's disk usage.

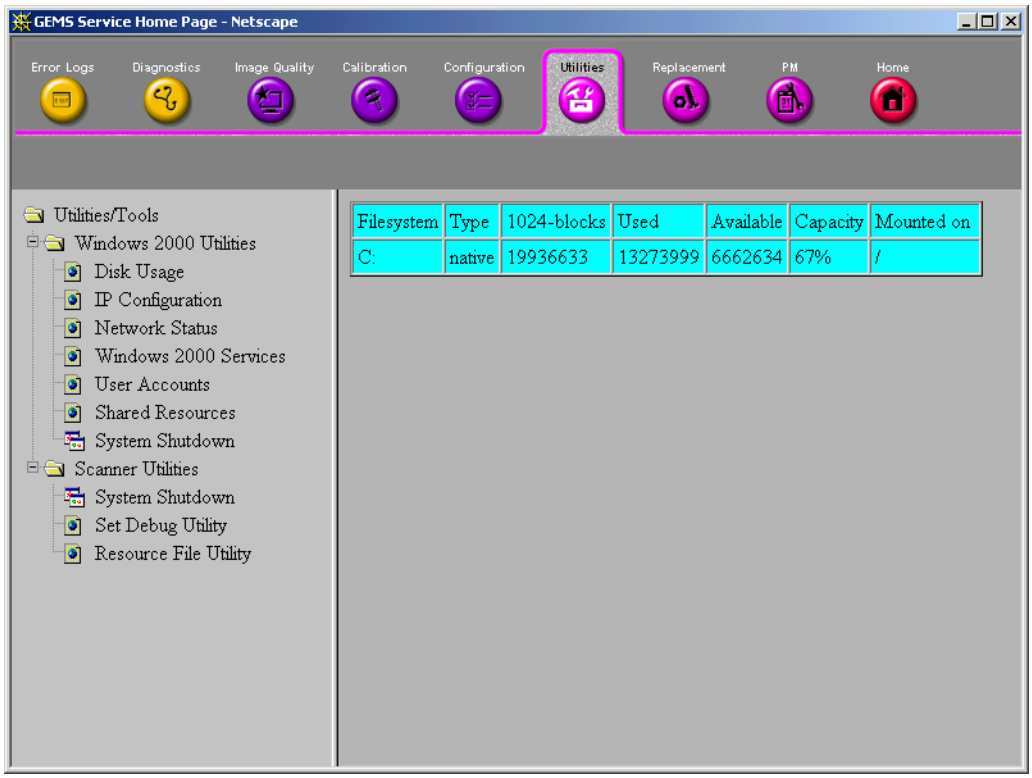


Figure 7-27 Disk Usage

7-2-11-1 Windows 2000 Utilities (cont'd)

2.) IP Configuration

The IP Configuration page gives you an overview of Vivid 7 / Vivid 7 PRO's Internet Protocol (IP) configuration.

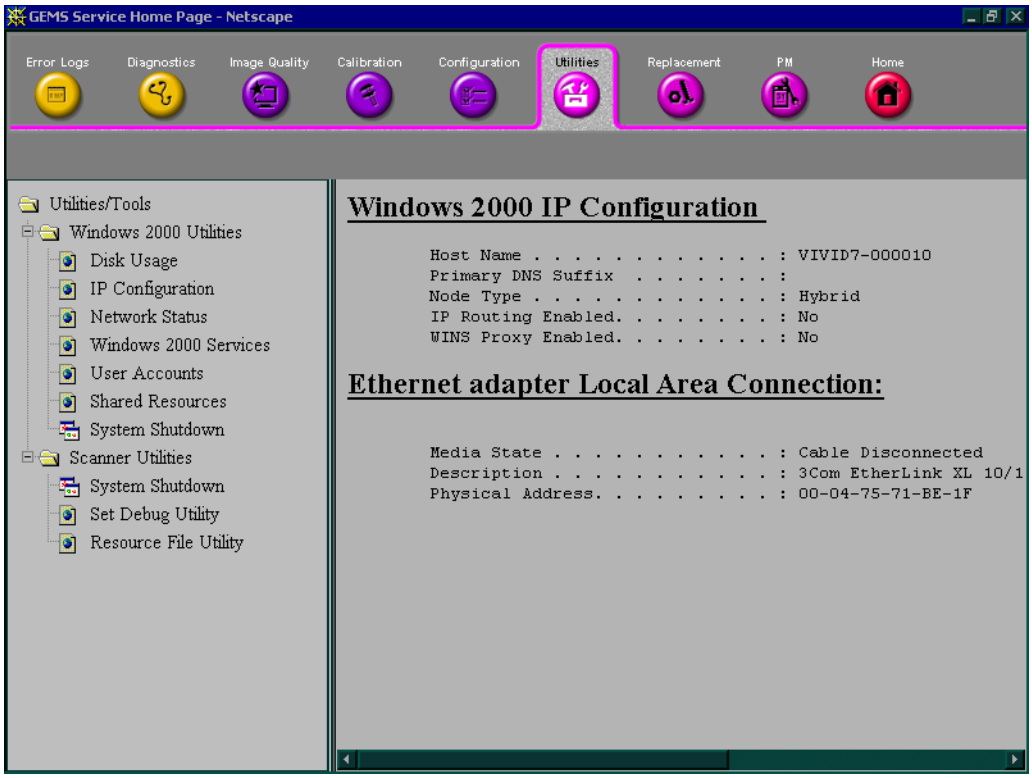


Figure 7-28 IP Configuration

7-2-11-1 Windows 2000 Utilities (cont'd)

3.) Network Status

This screen displays all open TCP/IP Ports on Vivid 7 / Vivid 7 PRO.

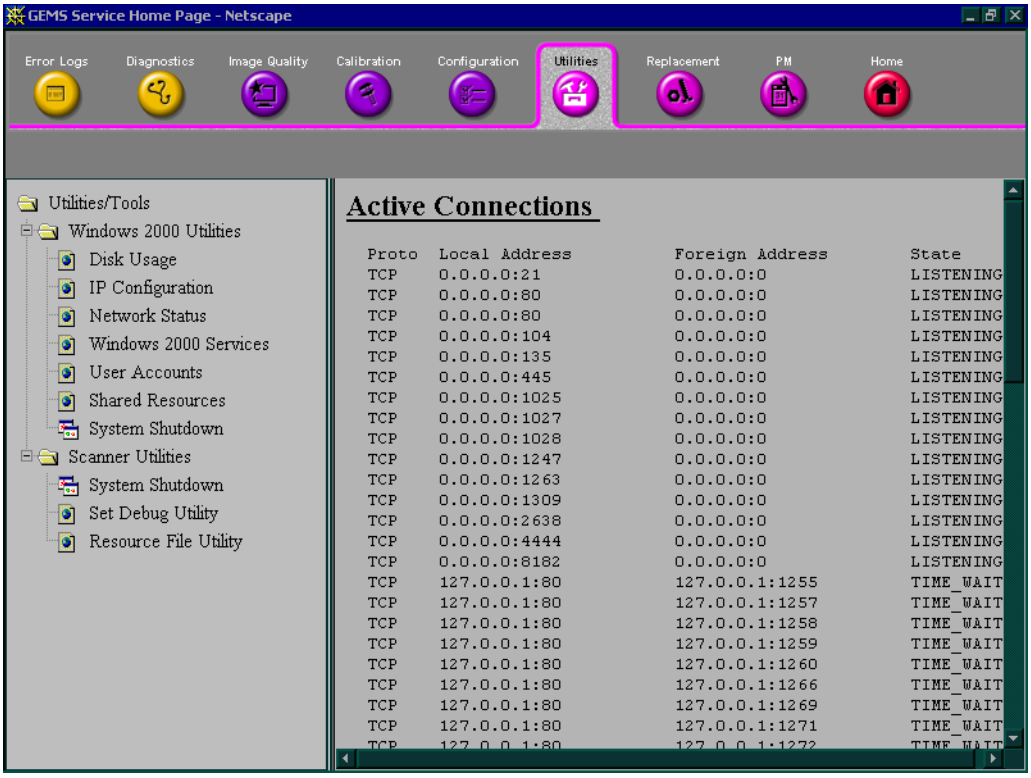


Figure 7-29 Network Status

7-2-11-1 Windows 2000 Utilities (cont'd)

4.) Windows 2000 Services

This page displays a list of active Windows 2000 services.

A Windows 2000 Service is a computer program that has been automatically started and is running in the background on the computer.



Figure 7-30 Windows 2000 Services

7-2-11-1 Windows 2000 Utilities (cont'd)

5.) User Accounts

This page lists the Users that has been given access to this Vivid 7 / Vivid 7 PRO.

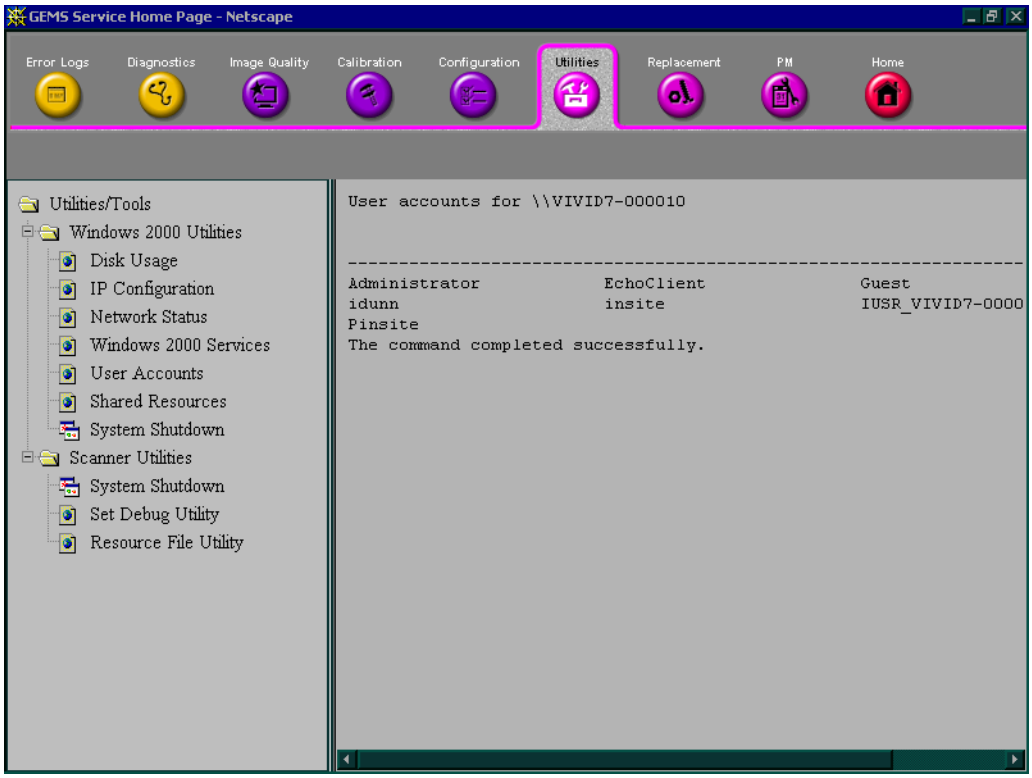


Figure 7-31 User Accounts

7-2-11-1 Windows 2000 Utilities (cont'd)

6.) Shared Resources

This screen displays all shared network resources on Vivid 7 / Vivid 7 PRO.

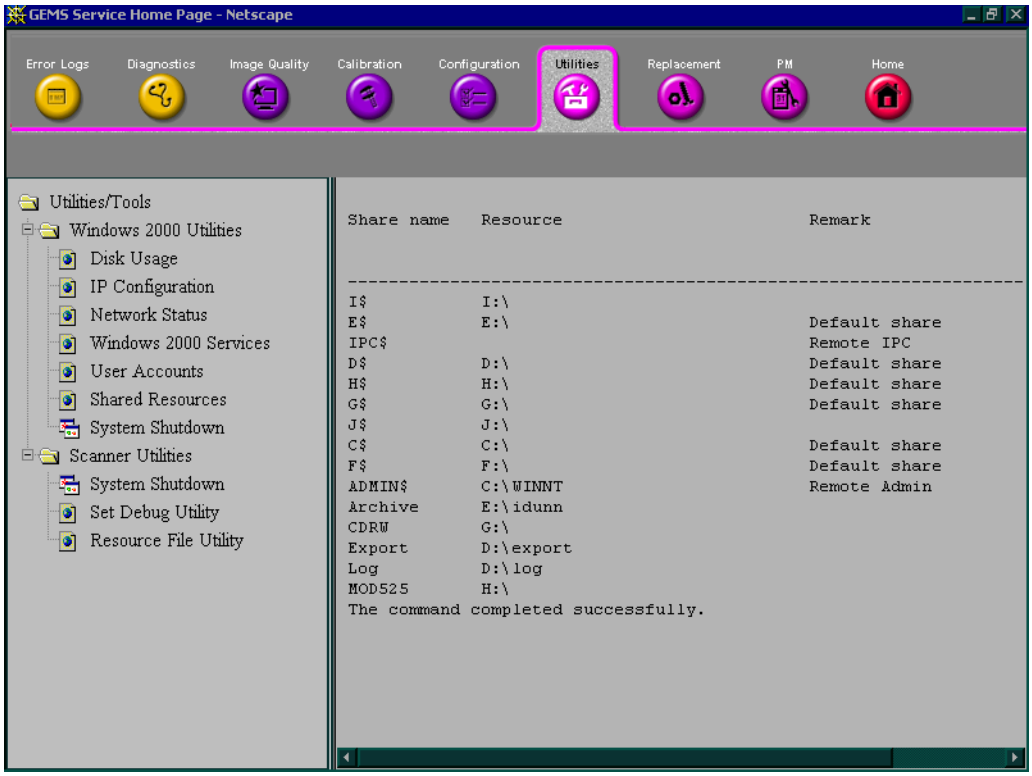


Figure 7-32 Shared Resources

7-2-11-1 Windows 2000 Utilities (cont'd)

7.) System Shutdown

NOTE: System Shutdown is intended for use from remote computer.

This menu gives you the ability to either Restart or Shutdown the Vivid 7 / Vivid 7 PRO.

NOTE: Retain Disruptive Mode should be kept unchecked if you are working locally on the scanner. It must be checked if working from an external computer.

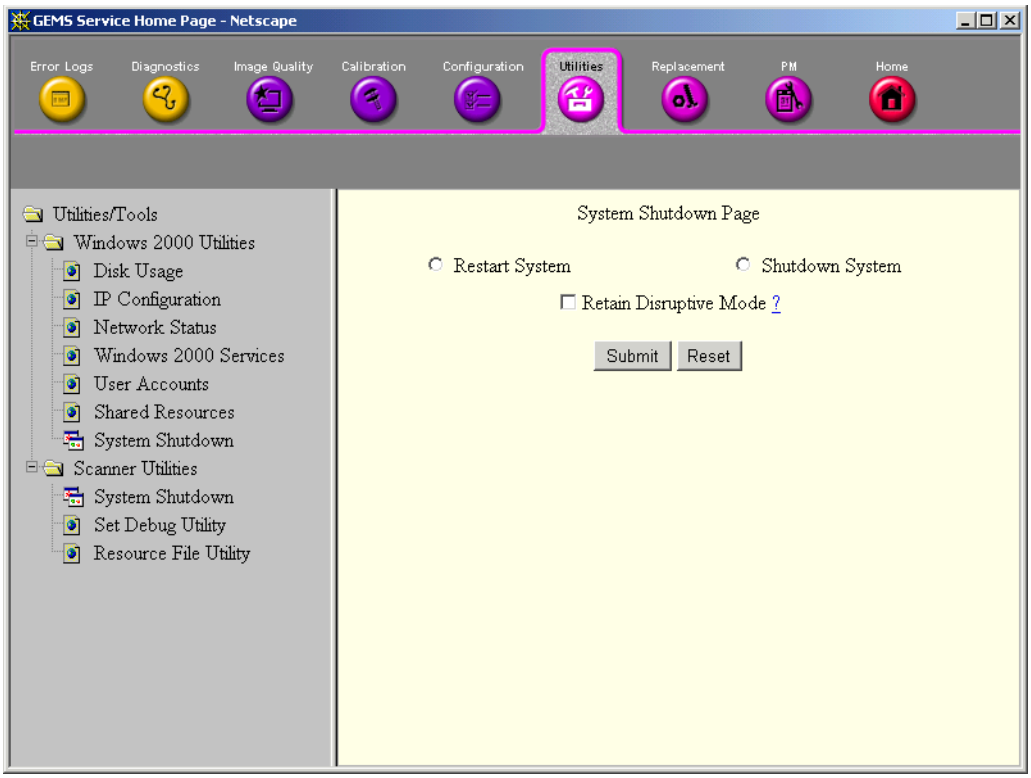


Figure 7-33 Restart or Shutdown System

7-2-11-2 Scanner Utilities

1.) System Shutdown

See "System Shutdown" on page 7-39.

2.) Set Debug Utility

This function is only to be used on Request from GE Service. It is used for setting Debug Variables.

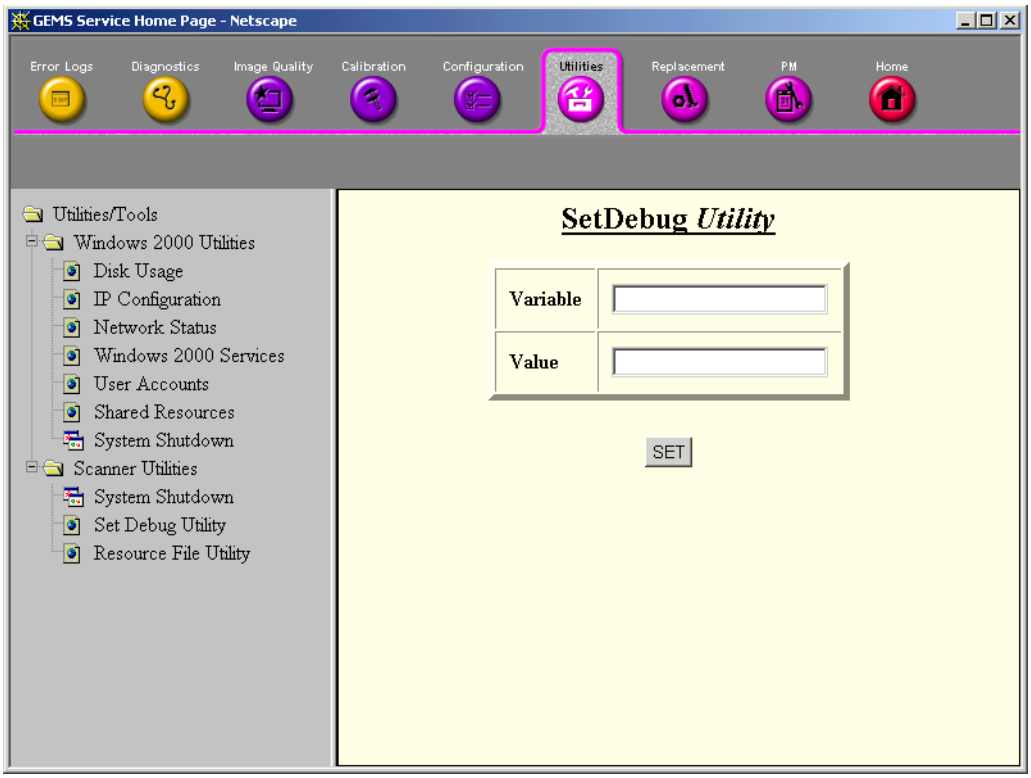


Figure 7-34 Set Debug Utility

7-2-11-2 Scanner Utilities (cont'd)

3.) Resource File Utility

From this page you can review the listed *User Defined Resource File* and save it to MO.

- View
  Click View to examine the User Defined Resource file on-screen.
- Save
  Click Save and navigate to the MO drive to save the User Defined Resource file.

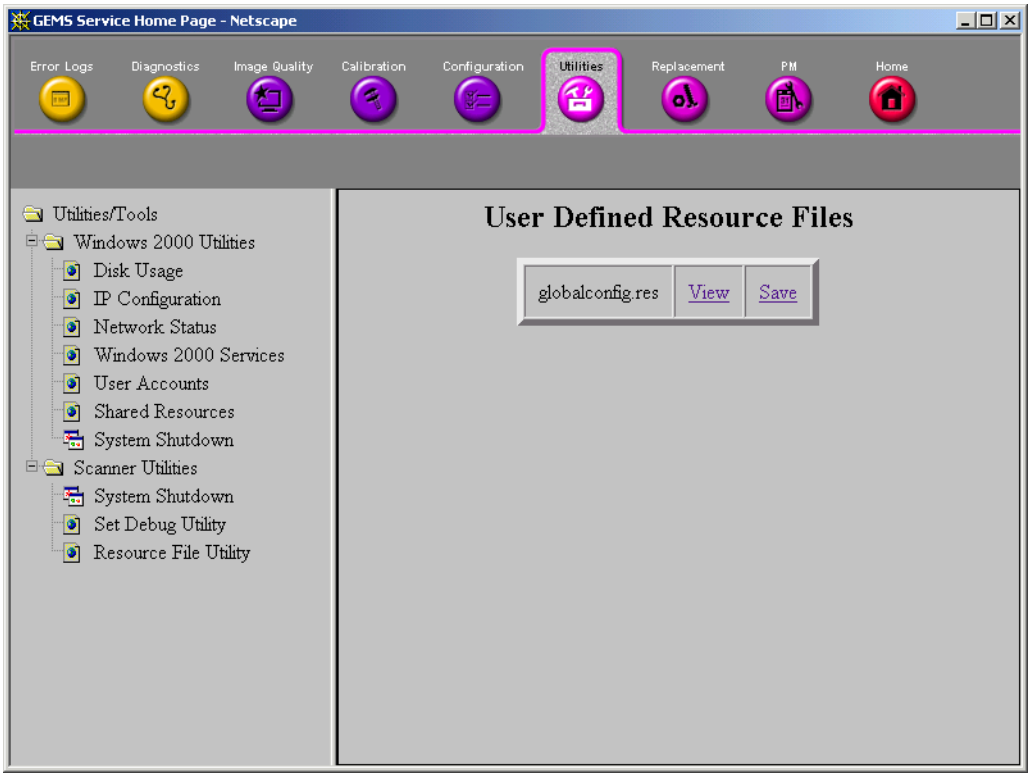


Figure 7-35 Resource File Utility

7-2-12 Replacement

Field is not populated.

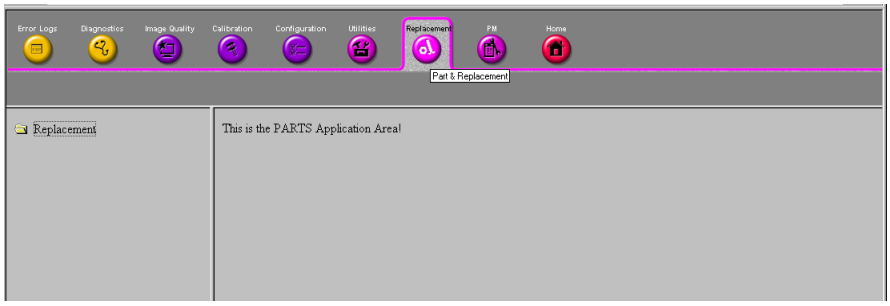


Figure 7-36 Part Replacement Page

7-2-13 PM

Field is not populated.

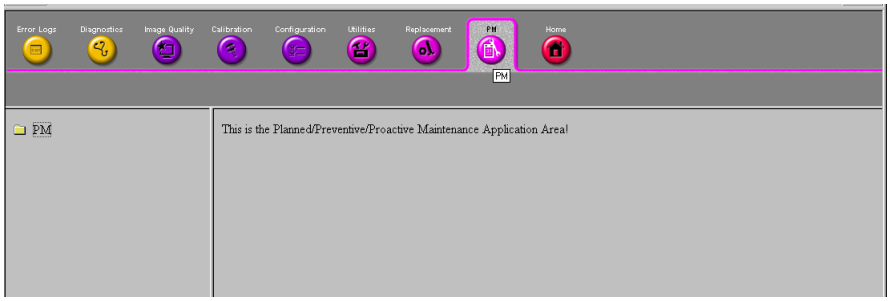


Figure 7-37 Planned Maintenance Page

7-2-14 Home

Click HOME to return to the Service Home Page.

7-2-15 Exit From Diagnostics

Click the “X” in the upper right corner of the screen to exit Diagnostics.

Section 7-3
Common Diagnostics

Common Diagnostics is a collection of diagnostics tools that are common for several of GE Ultrasound's products.

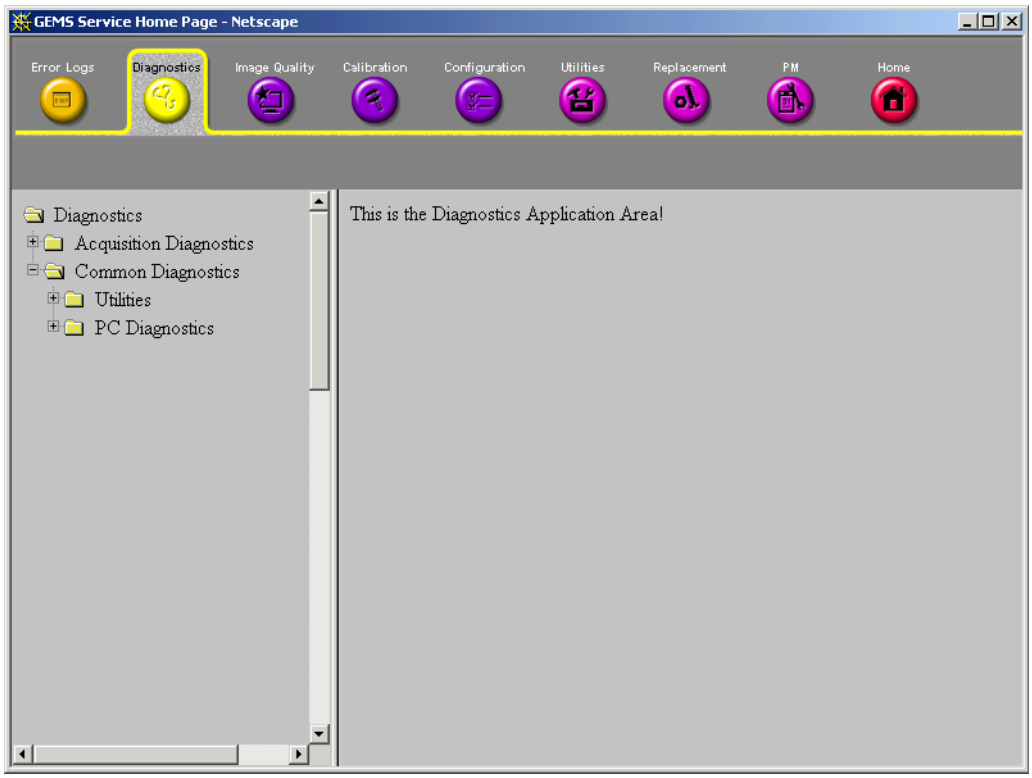


Figure 7-38 Common Diagnostics

The Common Diagnostics folder has two sub-folders:

- Utilities
- PC Diagnostics

7-3-1 Common Diagnostics - Utilities

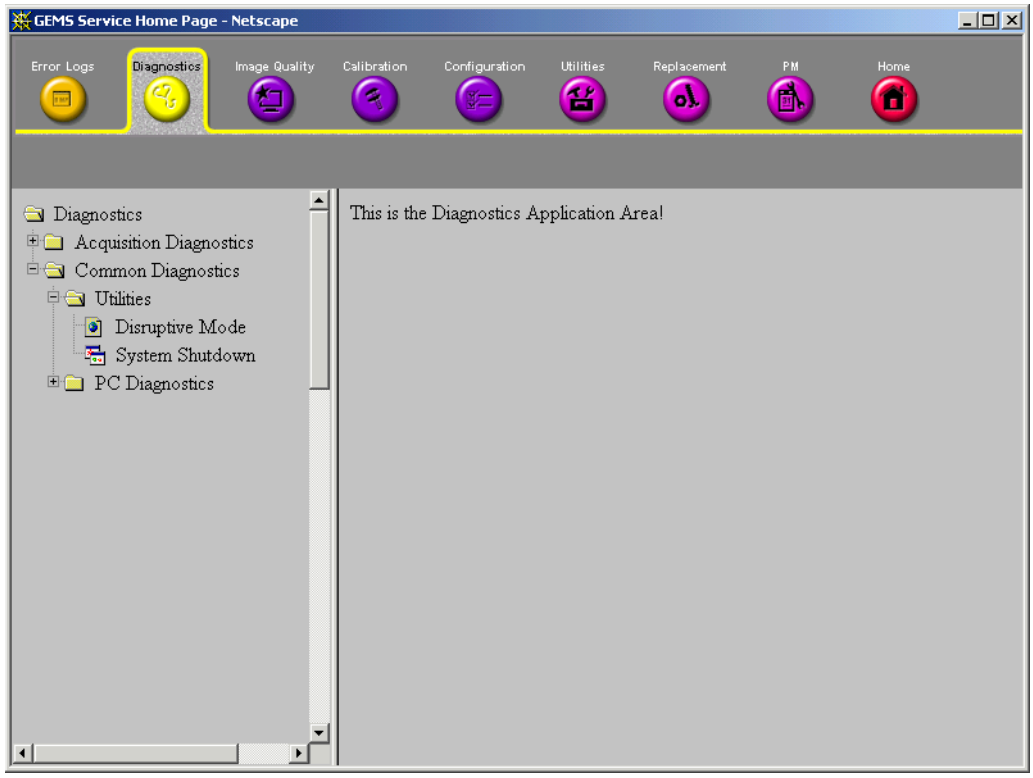


Figure 7-39 Common Diagnostics - Utilities

Utilities has two tools, both intended for use when connecting from a remote connected computer:

1.) Disruptive Mode
2.) System Shutdown

7-3-1-1 Disruptive Mode

Disruptive Mode Utility is used to enable/disable Disruptive Mode.

Disruptive Mode must be used if a remote computer is used to control Vivid 7 / Vivid 7 PRO. Example: InSite.

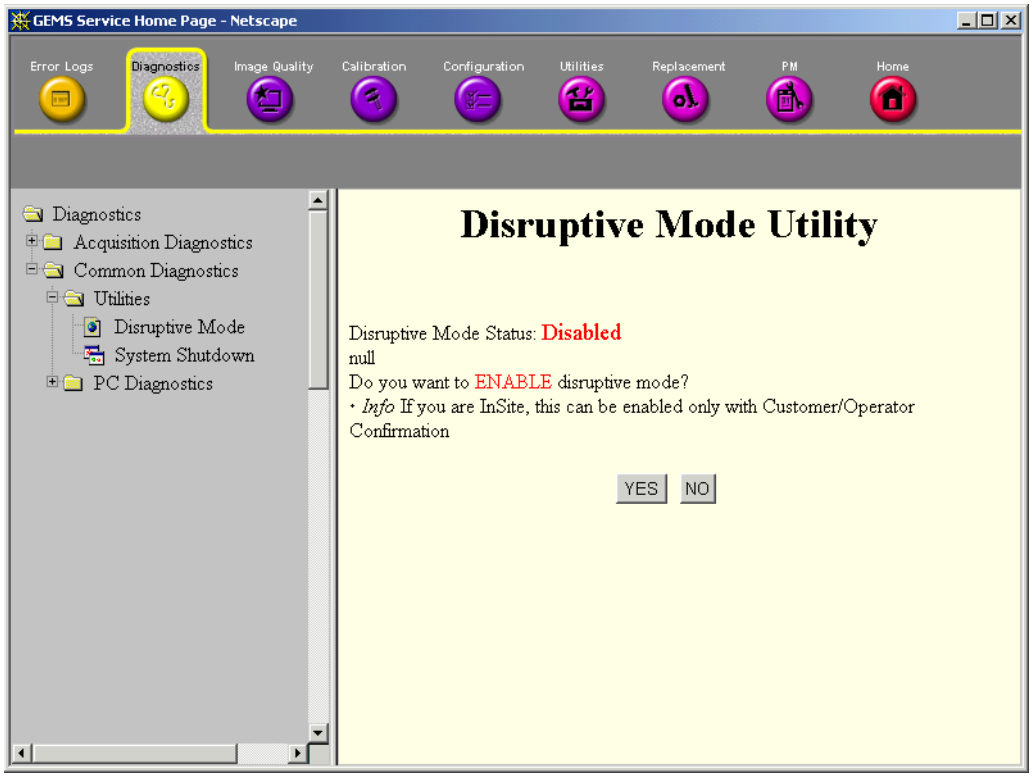


Figure 7-40 Common Diagnostics - Utilities - Disruptive Mode Utility

7-3-1-2 System Shutdown

Intended for use from remote computer. *See "System Shutdown" on page 7-39.*

7-3-2 PC (Backend Processor) Diagnostics, Non-Interactive Tests

The following sub-sections outline the non-interactive BEP Diagnostic tests.

7-3-2-1 CPU Tests

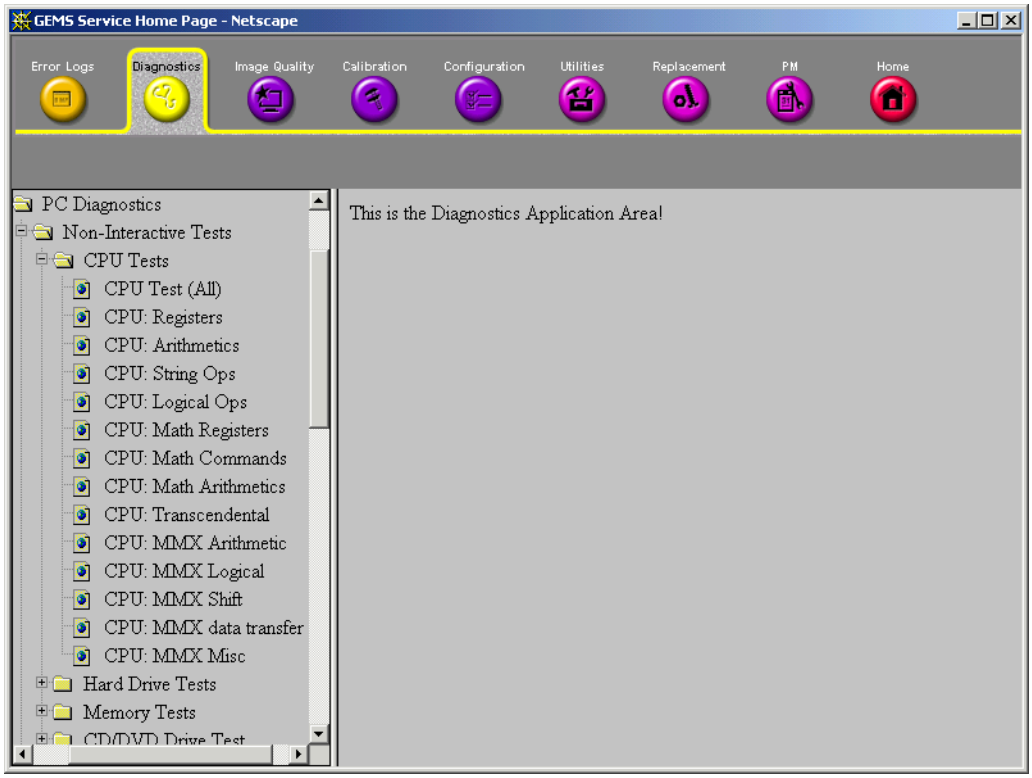


Figure 7-41 CPU Tests

- **CPU Test (All)** - This diagnostic performs a battery of tests on your CPU to ensure it is working properly. The following tests are a complete list of the tests performed on the PC's CPU.
- **CPU: Registers** - The CPU registers are tested using the default test patterns defined above. On 32 bit CPUs, the extended registers are also checked. If errors are detected, the failed registers are listed.
- **CPU: Arithmetic** - Tests the proper function of arithmetic commands ADC, ADD, DEC, DIV, IDIV, IMUL, INC, MUL, SBB and SUB with 16 and 32-bit operands. If errors are detected, the failed commands and operands are listed.
- **CPU: String Operations** - Tests the proper operation of string commands LODS, MOVS, SCAS and STOS with 8, 16 and 32-bit operands. If errors are detected, the failed commands and operands are listed.
- **CPU: Logical Operations** - Tests the proper operation of logical operations AND, NOT, OR and XOR with 16 and 32-bit operands. If errors are detected, the failed operands are listed.
- **CPU: Math Registers** - Tests coprocessor register stack, pointers and commands FLDLZ, FLDPI, FLDLN2, FLDLG2, FLDL2T, FLDL2E and FLD1. If errors are detected, the failed steps and commands are listed.
- **CPU: Math Commands** - Tests coprocessor commands FBLD/FBSTP, FLD/FST, FXCH, FCOM, FICOM, FTST, FXAM and FUCOM. If errors are detected, the failed instructions are listed.

7-3-2-1 CPU Tests (cont'd)

- **CPU: Transcendental** - Tests coprocessor transcendental commands F2XM1, FPATAN, FPTAN, FYL2X, FYL2XP1, FCOS, FSIN and FSINCOS. If errors are detected, the failed commands are listed.
- **CPU: MMX Arithmetic** - Tests MMX commands PADD, PSUB, PMUL and PMADD. If errors are detected, the failed commands are listed.
- **CPU: MMX Logical** - Tests MMX commands PAND, PANDN, POR and PXOR. If errors are detected, the failed commands are listed.
- **CPU: MMX Shift** - Tests MMX commands PSLL and PSRL. If errors are detected, the failed commands are listed.
- **CPU: MMX Data Transfer** - Tests MMX commands MOVD and MOVQ. If errors are detected, the failed commands are listed.
- **CPU: MMX Misc.** - Tests MMX commands PCMPEQ, PCMPGT, PACKSS, PACKUS, PUNPCK and PUNPCK. If errors are detected, the failed commands are listed.

7-3-2-2 Hard Drive Tests

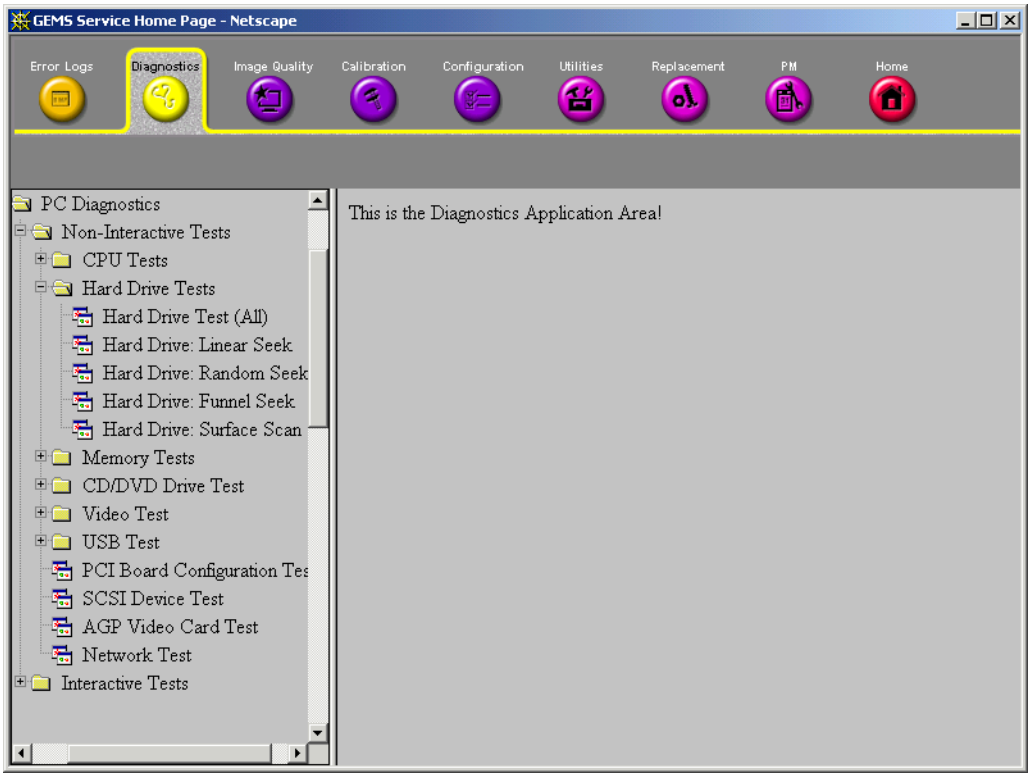


Figure 7-42 Hard Drive Tests

- **Hard Drive Test (All)** - The Hard Drive test examines your hard disk drive using a series of tests to ensure that your drive can perform its functions.

  The following tests are performed on your hard drive to ensure the hard disk controller and the drive mechanism are working correctly. The disk surface itself is also checked.

NOTE: The hard drive test can take over ten minutes.

- **Hard Drive: Linear Seek** - Hard disk drive heads are moved from track 0 to the maximum track one track at a time.
- **Hard Drive: Random Seek** - Hard disk drive heads are moved randomly several hundred times.
- **Hard Drive: Funnel Seek** - Hard disk drive heads are moved in a funnel fashion, i.e., from the first track on the drive to the last, then to the second track, then to the second to last track, then to the third track, and so on.
- **Hard Drive: Surface Scan** - This test scans for surface defects on the hard disk drive.

7-3-2-3 Memory Tests



Figure 7-43 Memory Tests

- **Memory Test (All)** - Eighteen test patterns are used to test memory locations. If errors are detected, the address of the block the error was detected in is shown. During testing, these diagnostics will also look out for parity errors and other exceptions. These will be added to the Test Log as errors if encountered.
- **Memory: Pattern Test** - The program uses several test patterns to test as much memory as possible.
- **Memory: Parity Test** - This test checks for parity errors on the memory bus during intensive string transfer operations. If an error is detected, the address of the failed block is displayed.

7-3-2-4 CD-ROM Drive Tests

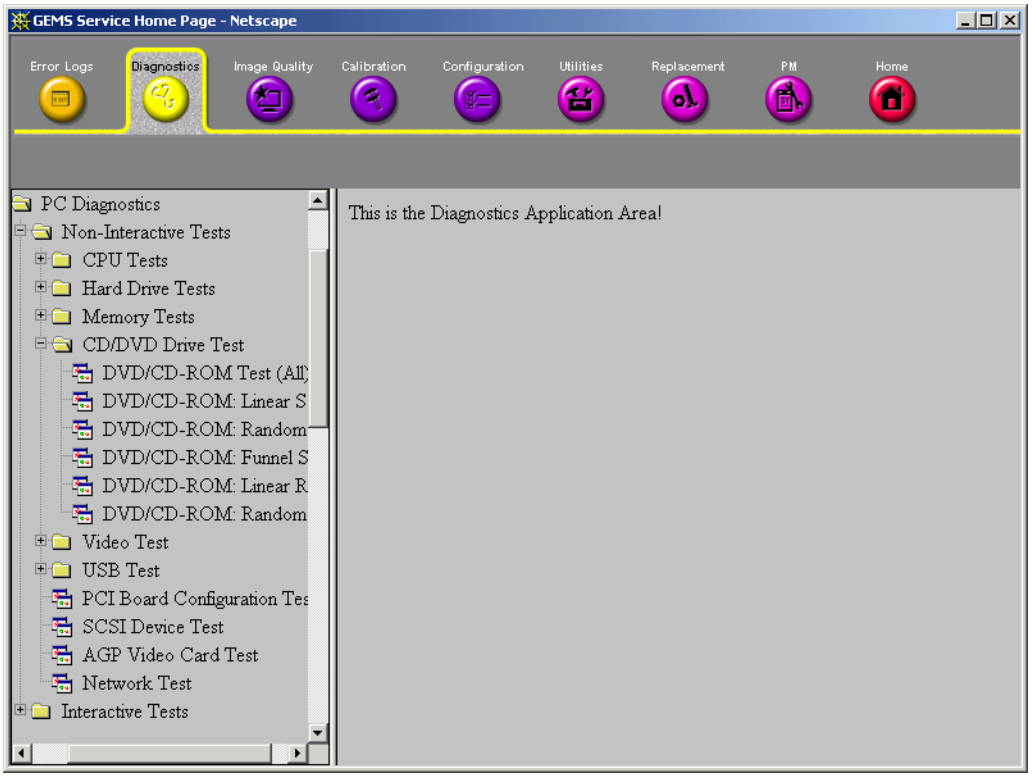


Figure 7-44 CD-Rom Drive Tests

- **CD-ROM Test (All)** - The CD-ROM test examines the CD-ROM drive to make sure it is working properly. Use a data CD-ROM disk for these tests. You cannot use an audio CD, such as a regular commercial music CD, with this test.

NOTE: The BEP is sometimes slow in recognizing a newly inserted CD-ROM disk. It is best to wait a few seconds after inserting a disk into the drive before you run any tests.

There are two types of CD-ROM tests:

1.) *Seek Tests:* Ensures the drive can access all locations on a disk, and
2.) *Read Tests:* Ensures the drive can read all the data.

- **CD-ROM: Linear Seek** - Tests that all locations can be accessed on a CD-ROM disk in a linear fashion, starting from the first to the last.
- **CD-ROM: Random Seek** - Tests that all locations can be accessed on a CD-ROM disk randomly.
- **CD-ROM: Funnel Seek** - Tests that all locations can be accessed on a CD-ROM disk in a funnel fashion, starting from the first then moving to the last, then, at the next pass starting from the second location then moving to the next to the last, and so on
- **CD-ROM: Linear Read** - Reads the data on the CD-ROM in a linear fashion, starting from the start to the end.
- **CD-ROM: Random Read** - Reads the data on the CD-ROM randomly.

7-3-2-5 Video Test



Figure 7-45 Video Tests

- **Video Test (All)** - This diagnostic tests your system's video capabilities. This involves testing the video memory with 18 patterns, testing your graphics acceleration, and text output. You will see these tests being performed on your monitor.

  You can cancel this test at any time by hitting the Escape (Esc) key.

The following tests are performed on your monitor:

- **Video: Memory** - Video memory is tested by filling the video buffer with 18 test patterns, one pattern at a time. The tests will fill the entire screen with a single color.
- **Video: Data Transfer** - This tests the graphics acceleration part of your video controller. These tests will appear on your screen as black and white concentric squares and rectangles of various sizes and colors. If errors are detected, the locations of the problems are displayed.
- **Video: Text Output** - This test prints a text string in random sizes and colors to tests your video device driver and video controller.

7-3-2-6 PCI Board Configuration Test

A bus is a set of circuits, wires or connectors which connect the various components of your system. A PCI (Peripheral Component Interconnect) bus is a fast standard bus which is common in Pentium systems. Various tests are run on the PCI bus in order to ensure it is working up to speed.

The motherboard is scanned to verify the configuration space and to make sure the diagnostics can communicate with the board.

7-3-3 PC (Backend Processor) Diagnostics, Interactive Tests

7-3-3-1 Keyboard Test

1.) Double-click **Keyboard Test** from the PC Diagnostics interactive tests menu.

2.) Click the EXECUTE button. A keyboard layout is displayed on which you can see the keys of a standard computer keyboard. Some of these keys are missing on Vivid 7 / Vivid 7 PRO.

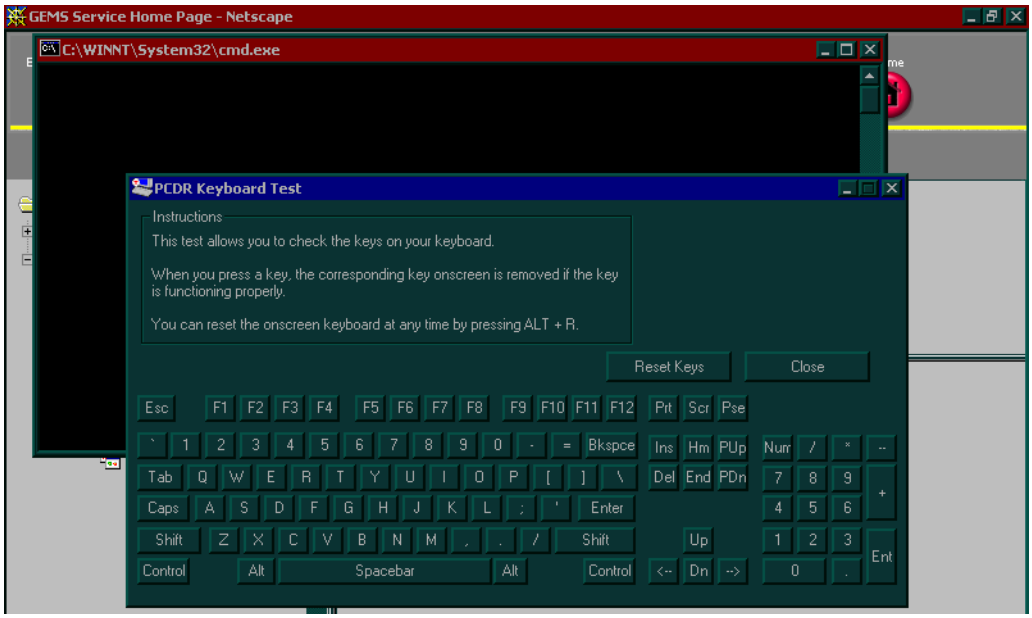

GEMS Service Home Page - Netscape
C:\WINNT\System32\cmd.exe
PCDR Keyboard Test
Instructions
This test allows you to check the keys on your keyboard.
When you press a key, the corresponding key onscreen is removed if the key is functioning properly.
You can reset the onscreen keyboard at any time by pressing ALT + R.
Reset Keys
Close

Figure 7-46 Keyboard Test

3.) Press each key on your keyboard once and make sure that the corresponding keys on-screen are removed from view. If a key on-screen is not removed, that key may be damaged and you may have to have your keyboard repaired or replaced. Since some of the displayed keys are missing on Vivid 7 / Vivid 7 PRO, they cannot be removed. See Figure 7-47.

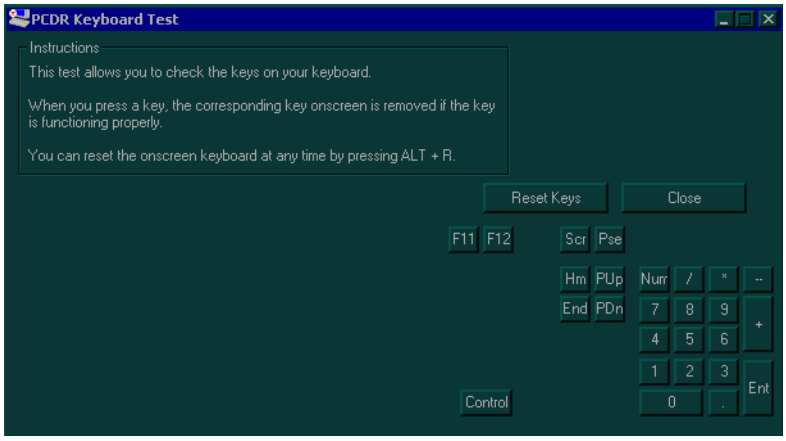

PCDR Keyboard Test
Instructions
This test allows you to check the keys on your keyboard.
When you press a key, the corresponding key onscreen is removed if the key is functioning properly.
You can reset the onscreen keyboard at any time by pressing ALT + R.
Reset Keys
Close

Figure 7-47 Remaining Keys On-screen After All Keyboard's Keys have been Pressed

4.) To reset the keyboard, click the Reset Keys button.

5.) To exit the test, click Close.

7-3-3-2 Audio Test

1.) Double-click **Audio Test** from the PC Diagnostic interactive tests menu.

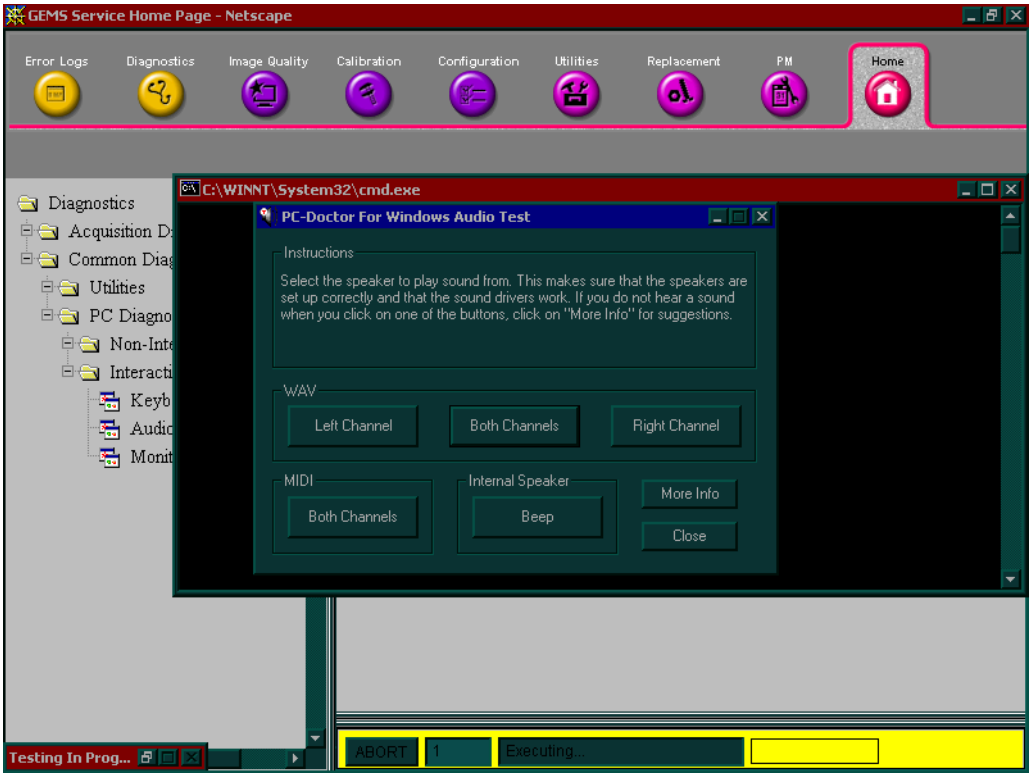


Figure 7-48 Sound Tests

2.) To test the WAV sound reproduction click Left Channel, Right Channel, or Both Channels to test your speakers. You should hear a guitar chord.

3.) To test MIDI sound reproduction click the button under MIDI. You should hear a few seconds of recorded music.

4.) Click on the Beep button. You should hear a low “beep” from your Backend Processor. (It may be difficult to hear due to noise from the fan.

If no sound is produced in these tests, choose the More Info button in the Audio Test dialog box for information about possible causes and solutions.

7-3-3-3 Monitor Test

Double-click **Monitor Test** from the PC Diagnostic interactive tests menu.

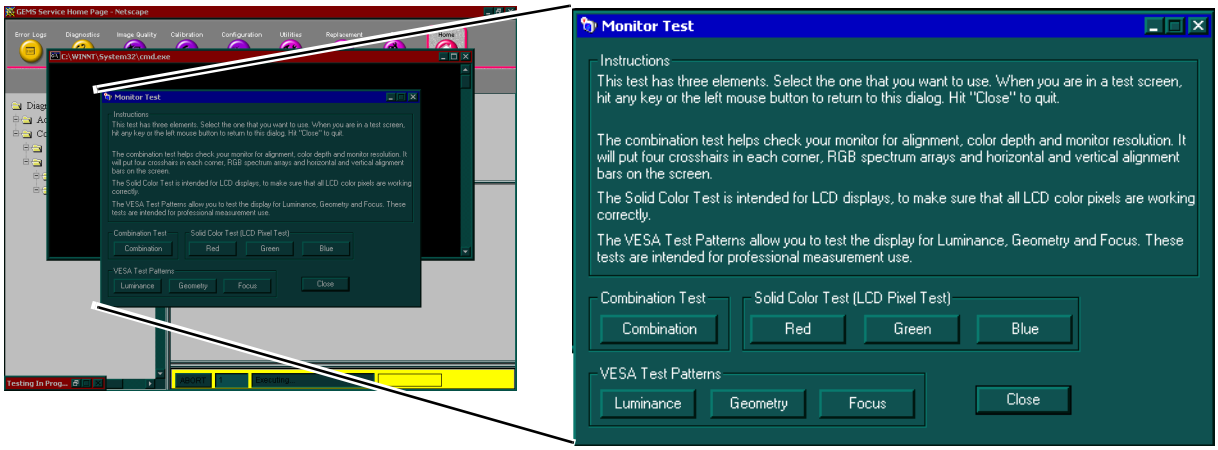

Monitor Test
Instructions
This test has three elements. Select the one that you want to use. When you are in a test screen, hit any key or the left mouse button to return to this dialog. Hit "Close" to quit.
The combination test helps check your monitor for alignment, color depth and monitor resolution. It will put four crosshairs in each corner, RGB spectrum arrays and horizontal and vertical alignment bars on the screen.
The Solid Color Test is intended for LCD displays, to make sure that all LCD color pixels are working correctly.
The VESA Test Patterns allow you to test the display for Luminance, Geometry and Focus. These tests are intended for professional measurement use.
Combination Test
Combination
Solid Color Test (LCD Pixel Test)
Red
Green
Blue
VESA Test Patterns
Luminance
Geometry
Focus
Close

Figure 7-49 Monitor Test

The monitor test dialog box presents you with three options:

- **Combination Test** - Checks the monitor for alignment, color depth, and monitor resolution. It will put four cross-hairs in each corner, RGB (Red Green Blue) spectrum arrays and horizontal and vertical alignment bars on the screen.

NOTE: In most cases, you will choose the Combination Test.

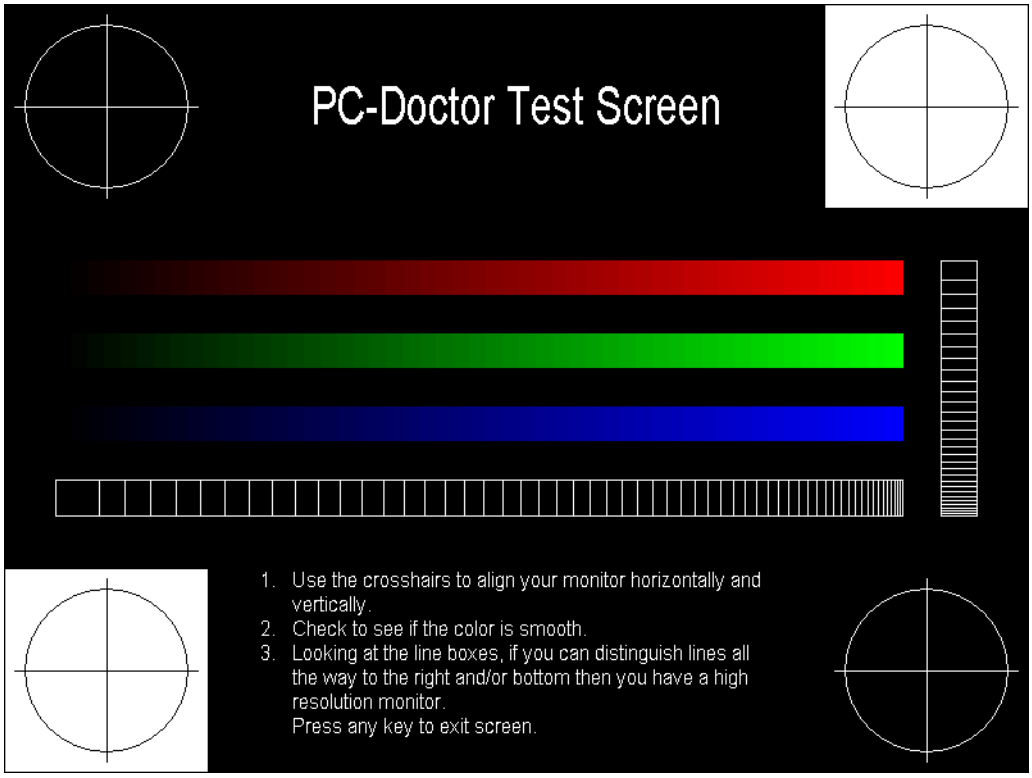

PC-Doctor Test Screen
1. Use the crosshairs to align your monitor horizontally and vertically.
2. Check to see if the color is smooth.
3. Looking at the line boxes, if you can distinguish lines all the way to the right and/or bottom then you have a high resolution monitor.
Press any key to exit screen.

Figure 7-50 Monitor Test

7-3-3-3 Monitor Test (cont'd)

- **Solid Color Test** - The solid color test is for laptop and LCD (Liquid Crystal Display) panel displays. This test displays solid color screens to allow you to make sure all color pixels are operating correctly.
- **VESA (Video Electronics Standards Association) Test Patterns** - The VESA test patterns checks luminance, geometry, and focus. The VESA tests are designed for professional measurement use.

7-3-3-3-1 Luminance

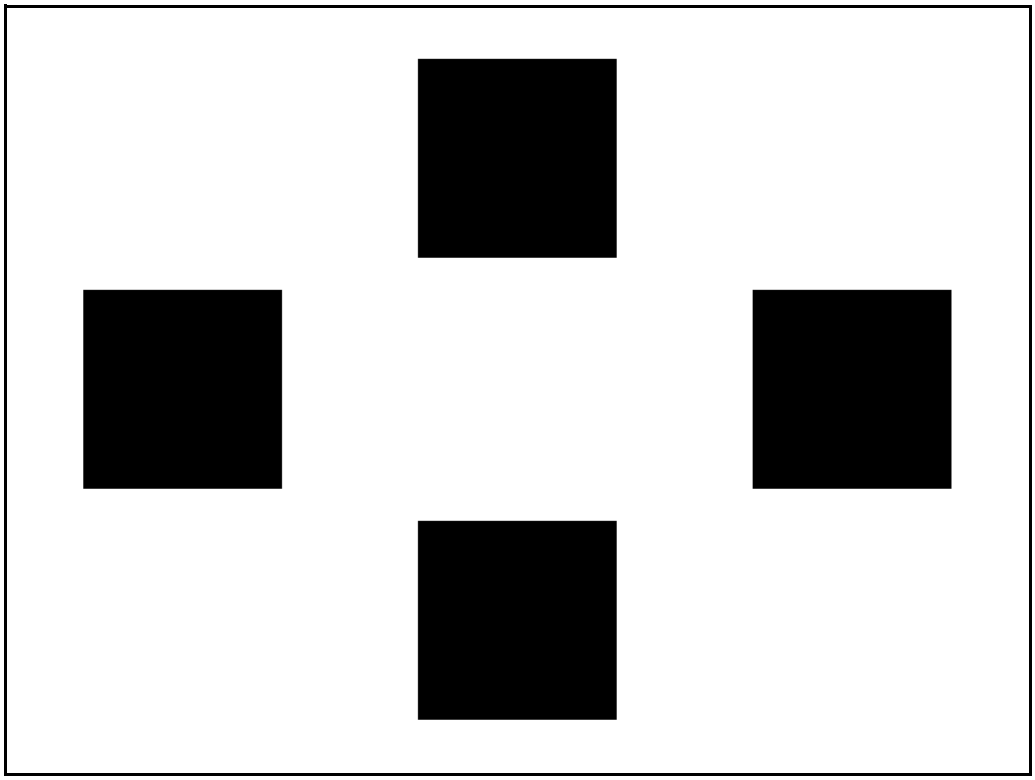


Figure 7-51 Monitor, VESA Test Pattern, Luminance

7-3-3-3 Monitor Test (cont'd)

7-3-3-3-2 Geometry

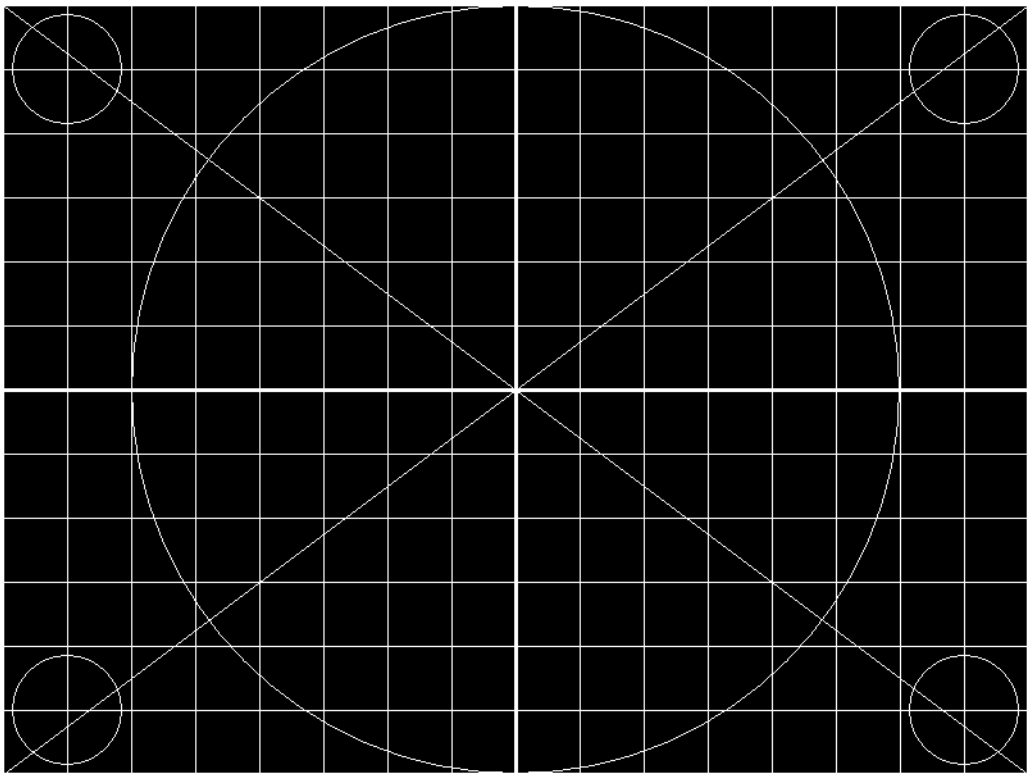


Figure 7-52 Monitor, VESA Test Pattern, Geometry

7-3-3-3 Monitor Test (cont'd)

7-3-3-3-3 Focus

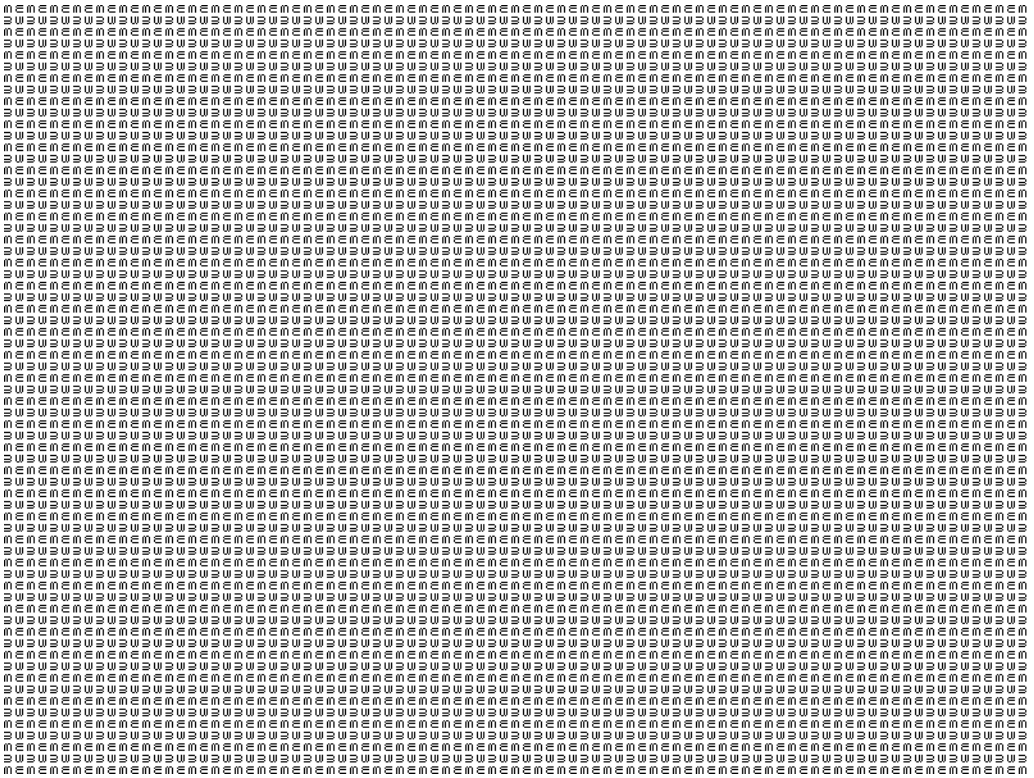


Figure 7-53 Monitor, VESA Test Pattern, Focus

Section 7-4
Acquisition Diagnostics

7-4-1 System Test Diagnostics Summary

- If the scanner is failing during start up or it don't start at all, please refer to *7-5-1-1 - System Doesn't Boot* on page *7-67*.
- If the scanner is running, but an error that may be a hardware failure, has been registered, then continue to read.

7-4-2 Start System Test

The Config Screen gives you access to the System Test (an automatic test).

To start the System Test, switch the scanner on, see 4-2-1 - Power ON/ Boot Up on page 4-2 for specific instructions.

After scanner initialization is complete, continue with the steps below;

1.) Press **CONFIG** on the keyboard and log on as *adm* to the System Config Screen.
2.) Select SYSTEM from the bottom of the menu that appears on the monitor.
3.) If not selected, click TEST.

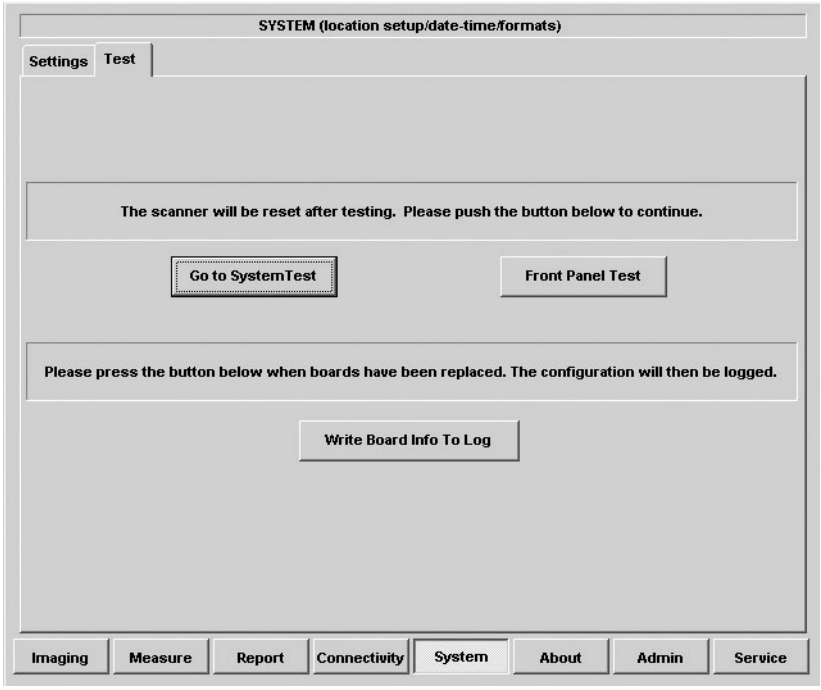


Figure 7-54 System > Test Selection Screen

4.) Click GO TO SYSTEMTEST to select the Calibration/Test screen.

7-4-3 Beamformer Calibration

When following the steps in 7-4-2 - Start System Test on page 7-59, the default screen will be the Calibration Screen.

From the Calibration Screen you can;

- Do DC Offset Calibration (DC Offs. Cal) of the A/D converters in the Front End.
- Reset the calibration (Cal. Reset) to the factory default setting.
- Show a graph regarding the calibration (Show graph).
- Deselect/Select channels are used in manufacturing to isolate noisy channels (Channel Control).
  With a linear probe connected to the system, it is possible to disconnect groups of channels either on the TX Board or on the RX Board to isolate the noise source.
- The buttons in the lower part of the screen are used for board testing (see 7-4-4 - System Test on page 7-61).

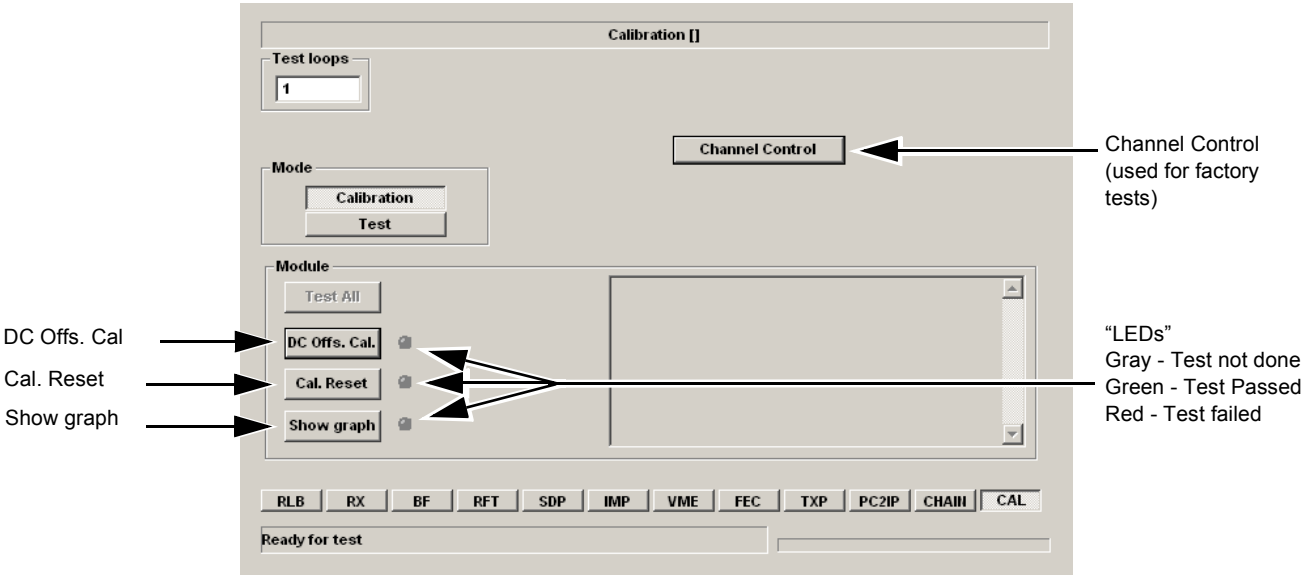


Figure 7-55 Calibration Dialog

To start a test, click the respective button.

The "LEDs" in Figure 7-55 will change color when a test has been done;

- Green indicates that the test passed.
- Red indicates that the test failed.

7-4-4 System Test

7-4-4-1 Select the Test Screen

From the Calibration Screen, select TEST or click one of the buttons (not CAL) in the lower part of the screen. See Figure 7-56 - Select Test Window.

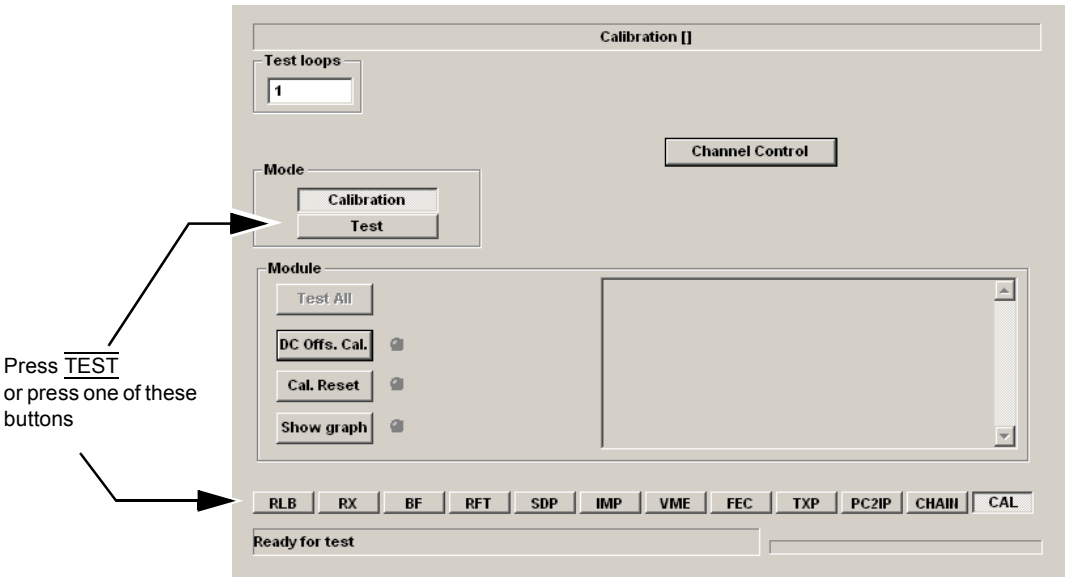


Figure 7-56 Select Test Window

The System Test Screen gives you access to the tests needed for troubleshooting the Front End Card Rack.

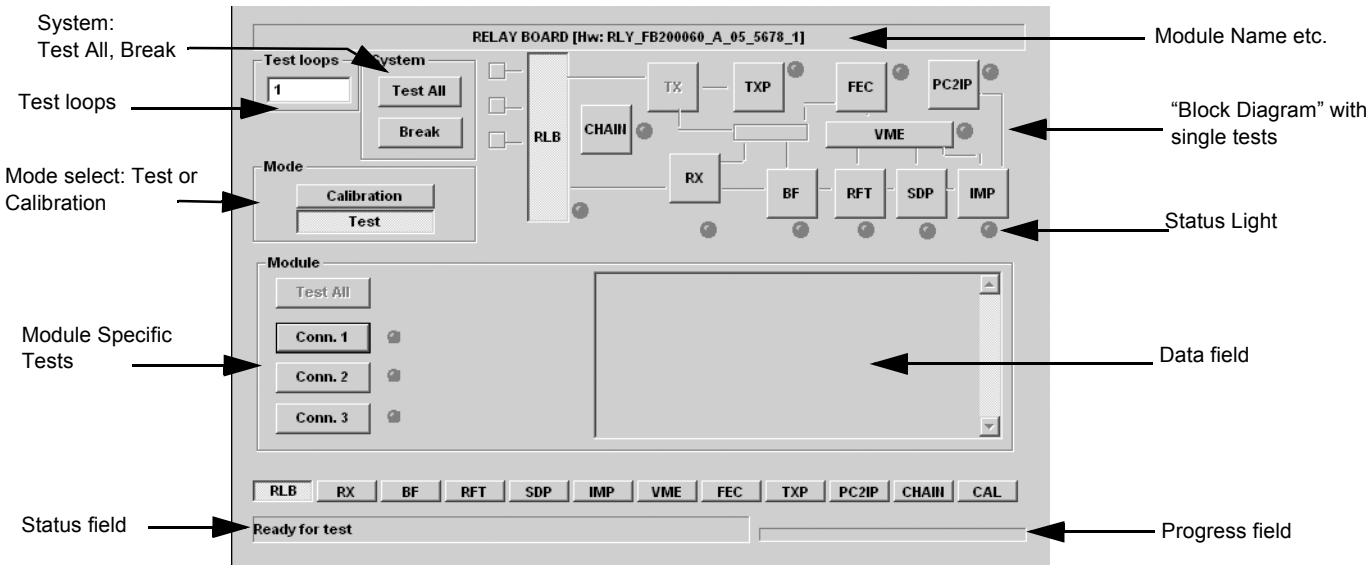


Figure 7-57 System Test Screen

7-4-4-2 System Test Screen Description

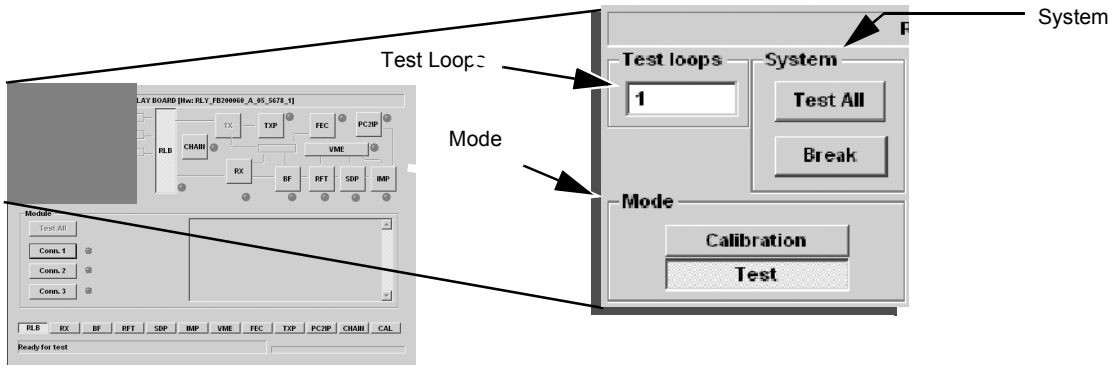


Figure 7-58 System Test Screen, Upper Part

7-4-4-2-1 Test Loops, System

Table 7-4 Test loops, System - Test All, System - Break

Field	Key	Description
Test loops	-	In some cases you may want to do the same test several times. Enter a number to indicate how many times you want the test to repeat itself. The default number is 1 (one).
System	**Test All**	Use this function to start a sequence of all the tests available in the Test Screen. The diagnostic test is done in this sequence; 1.) PC2IP 2.) IMP (Image Port Board) 3.) VME (VME data bus on the Back Plane) 4.) SDP (Spectrum Doppler Processor) 5.) RFT (Radio Frequency & Tissue Board) 6.) FEC (Front End Controller Board) 7.) BF (Beam Former Boards) 8.) RX (Receiver Board) 9.) TXP (TX Power) *NOTE: Relay Board (RLB) and Chain are not tested in this test. The Transmitter Board (TX) don't have its own test, but some parts of the TX board is tested during the FEC test.* *NOTE: If the system must be rebooted, do so. Continue with the testing from the point at which you were required to stop.*
System	**Break**	If you have started a looped test, you may click BREAK to stop the test. The test will continue until the current test has finished.

7-4-4-2 System Test Screen Description (cont'd)

7-4-4-2-2 Mode (Calibration/Test Screen Selection)

Table 7-5 Mode (Calibration/Test Screen selection)

Field	Key	Description
Mode		The buttons in this field are used to select the Calibration Screen or the Test Screen.
	Calibration	Click this button to select the Calibration Screen.
	Test	Click this button to select the Test Screen.

7-4-4-2-3 "Block Schematics" with Single Tests

Click one of the buttons in the "block schematics" in the upper part of the screen (or one of the duplicate buttons in the lower row of the screen) to select a particular test.

Some of the tests are described after the figure.

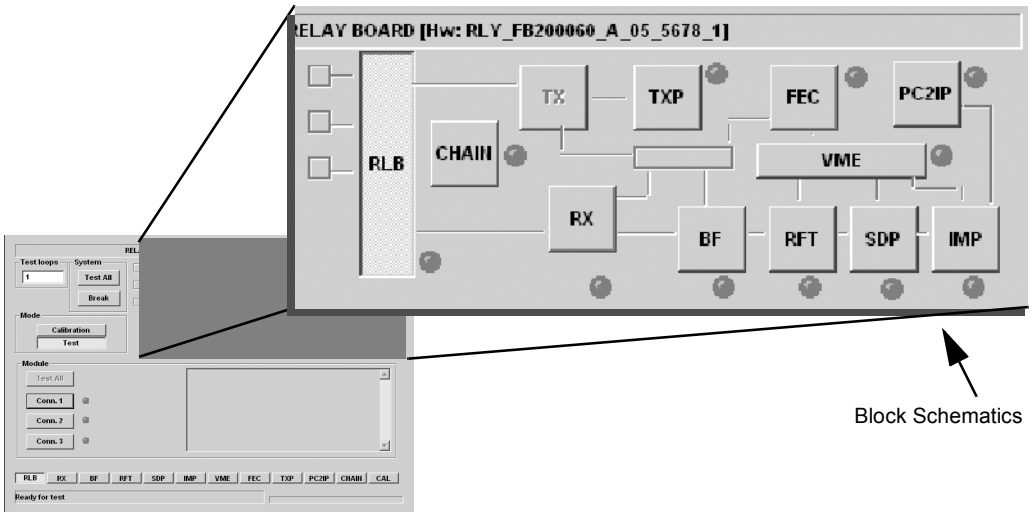


Figure 7-59 Diagnostics Test Screen, Upper Part

7-4-4-2-4 Receiver Board (RX) Test

Table 7-6 Receiver Board (RX) Test

Test (Key)	Sub-tests	Description
RX		**Receiver Board (RX)**
	Test All	Activates the following tests, in sequence, see description for each sub test; • RECV0 • RECV1
	RECV.0	Max Gain test for RX using FEC signal generator.
	RECV.1	Reduced Gain test for RX using FEC signal generator.

7-4-4-2 System Test Screen Description (cont'd)

7-4-4-2-5 Relay Board Test

NOTE: A Test Attenuator, Part Number AA200215 is needed for this test.

Table 7-7 Relay Board (RLB) Test

Test (Key)	Sub-tests	Description
RLB		**Relay Board (RLB)**
	Test All	Activates the following tests, in sequence (see the descriptions for the tests below); 1. Conn. 1 2. Conn. 2 3. Conn. 3
	Conn. 1	Max Gain test for RX using the signal generator on the Front End Controller (FEC) and a Test Attenuator, Part Number AA200215, in left (active) probe connector.
	Conn. 2	Max Gain test for RX using the signal generator on the Front End Controller (FEC) and a Test Attenuator, Part Number AA200215, in mid (active) probe connector.
	Conn. 3	Max Gain test for RX using the signal generator on the Front End Controller (FEC) and a Test Attenuator, Part Number AA200215, in right probe connector.

7-4-4-2-6 Chain (Signal Chain, RLB/RX/BF Test)

NOTE: A Test Attenuator, Part Number AA200215 is needed for this test.

Table 7-8 Signal Chain (TX/RLB/RX/BF) Test

Test (Key)	Sub-tests	Description
Chain		**Signal Chain Test (Chain)** The Signal Chain/ Data Flow test checks for errors in the TX, RLY, RX and BF chain of data flow.
	Test All	Not Used.
	TX/RLB/RX/ BF	Tests data flow in Front End Transmit Receive signal chain. If an error occurs with this test, testing should be continued in the following order; 1. BF digital and analog test 2. RX test 3. RLY test.

7-4-5 Beamformer Calibration (Front End Alignment)

Beamformer Calibrations are performed to calibrate each ADC channel of the two Beam Former (BF) board inputs. The system calibrates the Beamformer ADCs to zero output when there is no signal on the input.

These bias voltages are stored on hard disk in Backend Processor.

7-4-5-1 When to Use this Procedure

This procedure should be performed;

- when installing a new Vivid 7 / Vivid 7 PRO
- after software has been updated or replaced
- when BF boards have been interchanged
- when a BF board has been replaced
- when the Backend Processor has been replaced

7-4-5-2 Front End Alignment Procedure

1.) Disconnect all connected probes.
2.) Turn on the scanner.
3.) Press **CONFIG** and log in as *adm*
4.) Click SYSTEM

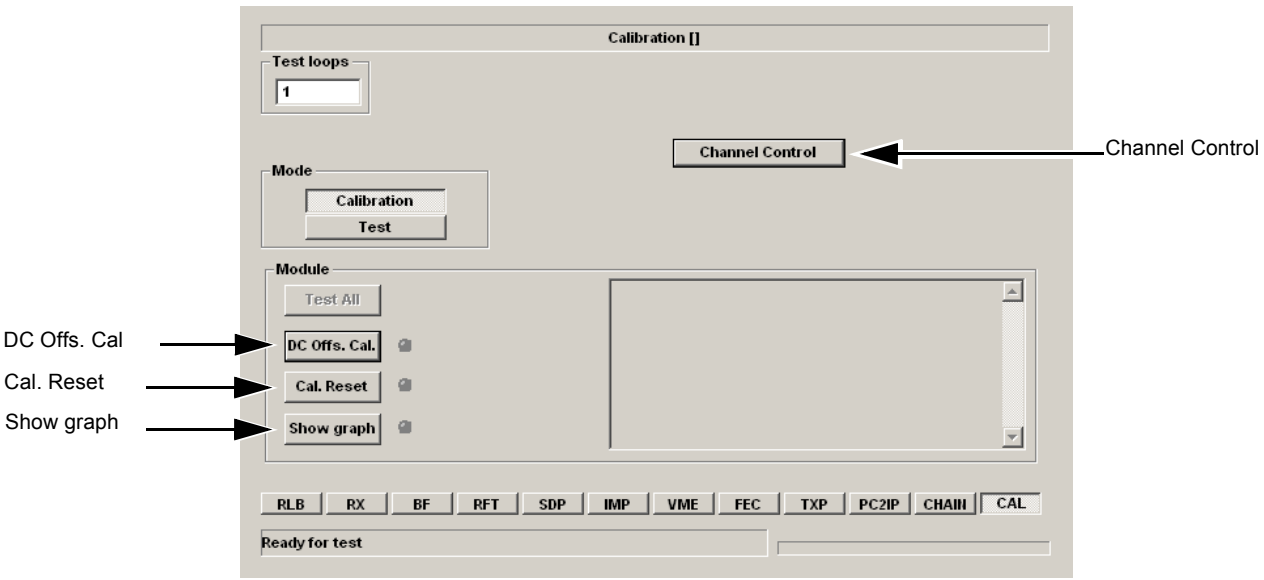


Figure 7-60 Calibration Dialog

5.) Click DC OFFS. CAL to start the DC Offset calibration of the Beam Formers (Front End Alignment).

7-4-5-2 Front End Alignment Procedure (cont'd)

Front End Alignment Description

- Each A/D converter will get 0V input (by setting ATGC to minimum).
- One by one channel will be digitized and the result put in the IQ buffer on the RFT board.
- The BEP will then read the IQ buffer and computes a value per channel. These computed values are compared to an upper/lower limit.
- If all read values are ok, the message PASSED will appear. If values exceeding the limits are read, the system will prompt you with FAILED and a message will tell you which BF board is bad.
- The resulting offsets for each channel are stored in a file on the Backend Processor's hard disk.
- The values can be plotted in a diagram (click SHOW GRAPH).

6.) Always reboot the scanner after Front End Alignment is finished and verify proper operation.

NOTE: Do Not select "Cal Reset" after performing calibration. This will destroy the file located on the Backend Processor and the image quality will not be optimized.

Section 7-5
Troubleshooting

7-5-1 Console Troubleshooting Trees

7-5-1-1 System Doesn't Boot

This is an overall diagram showing a recommended sequence for troubleshooting a no-boot situation.

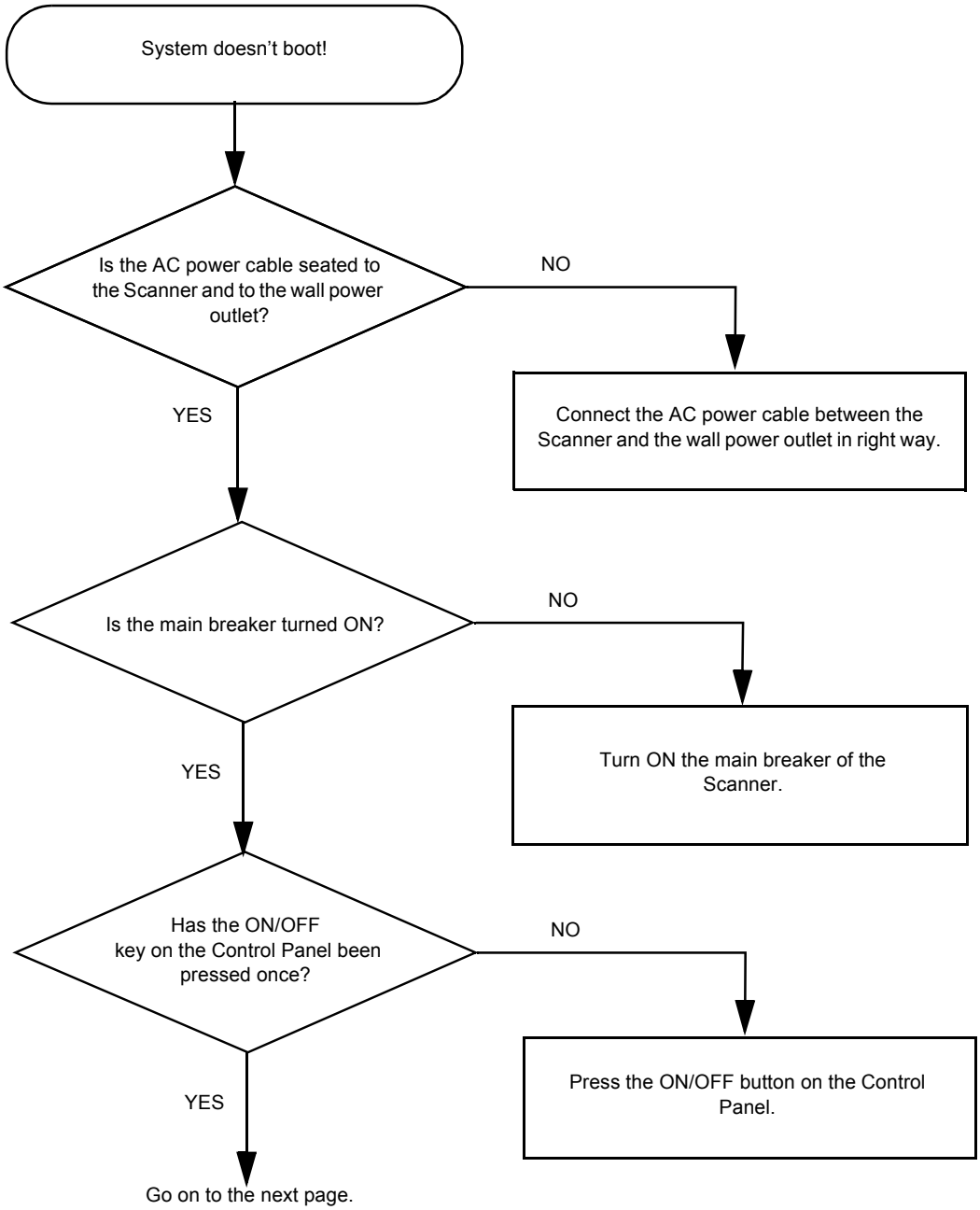

System doesn't boot!
Is the AC power cable seated to the Scanner and to the wall power outlet?
NO
Connect the AC power cable between the Scanner and the wall power outlet in right way.
YES
Is the main breaker turned ON?
NO
Turn ON the main breaker of the Scanner.
YES
Has the ON/OFF key on the Control Panel been pressed once?
NO
Press the ON/OFF button on the Control Panel.
YES
Go on to the next page.

Figure 7-61 System Doesn't Boot

7-5-1-1 System Doesn't Boot (cont'd)

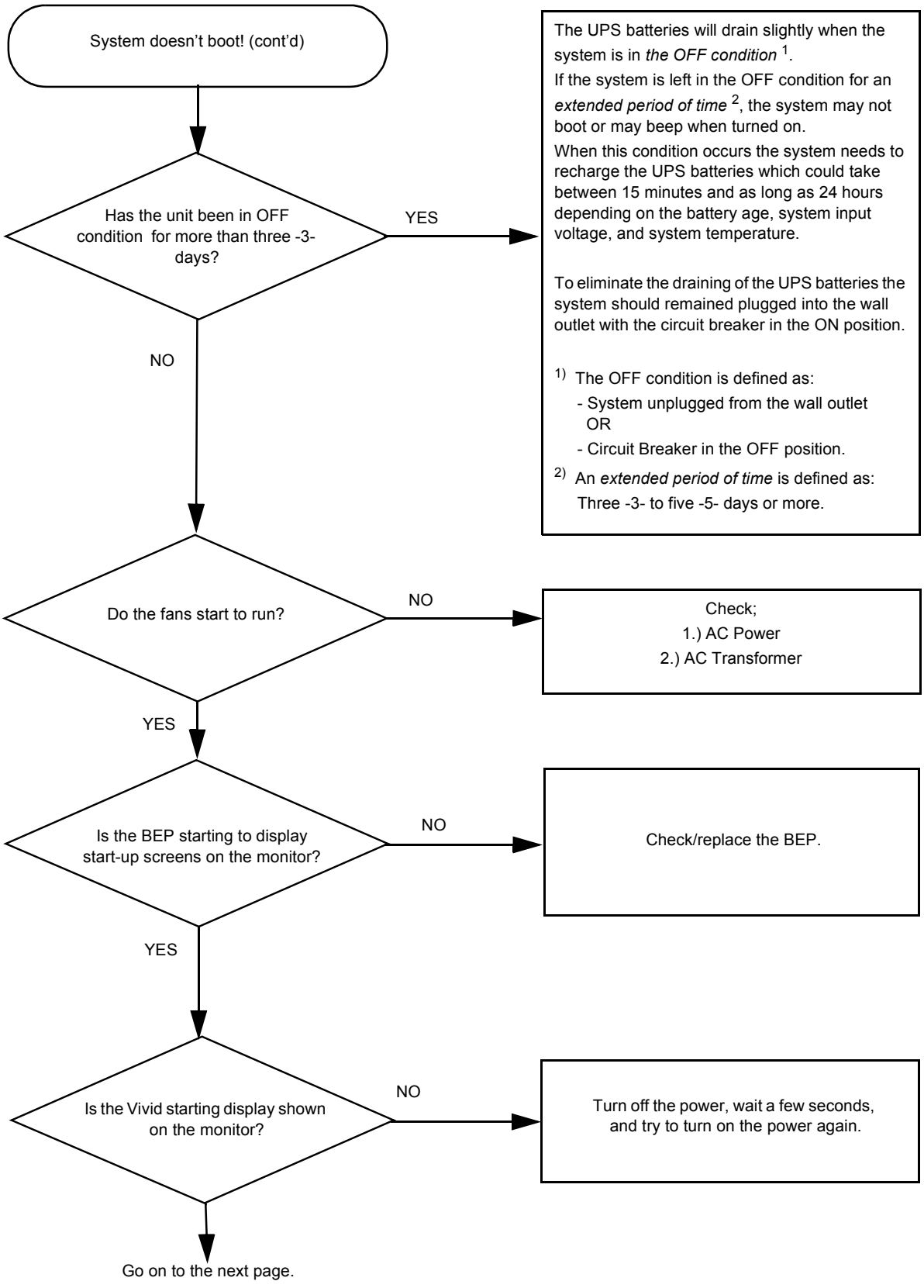

System doesn't boot! (cont'd)
Has the unit been in OFF condition for more than three -3- days?
YES
NO
The UPS batteries will drain slightly when the system is in *the OFF condition* [1].
If the system is left in the OFF condition for an *extended period of time* [2], the system may not boot or may beep when turned on.
When this condition occurs the system needs to recharge the UPS batteries which could take between 15 minutes and as long as 24 hours depending on the battery age, system input voltage, and system temperature.
To eliminate the draining of the UPS batteries the system should remained plugged into the wall outlet with the circuit breaker in the ON position.
1) The OFF condition is defined as:
- System unplugged from the wall outlet OR
- Circuit Breaker in the OFF position.
2) An *extended period of time* is defined as:
Three -3- to five -5- days or more.
Do the fans start to run?
NO
Check;
1.) AC Power
2.) AC Transformer
YES
Is the BEP starting to display start-up screens on the monitor?
NO
Check/replace the BEP.
YES
Is the Vivid starting display shown on the monitor?
NO
Turn off the power, wait a few seconds, and try to turn on the power again.
Go on to the next page.

Figure 7-62 System Doesn't Boot (cont'd)

7-5-1-1 System Doesn't Boot (cont'd)

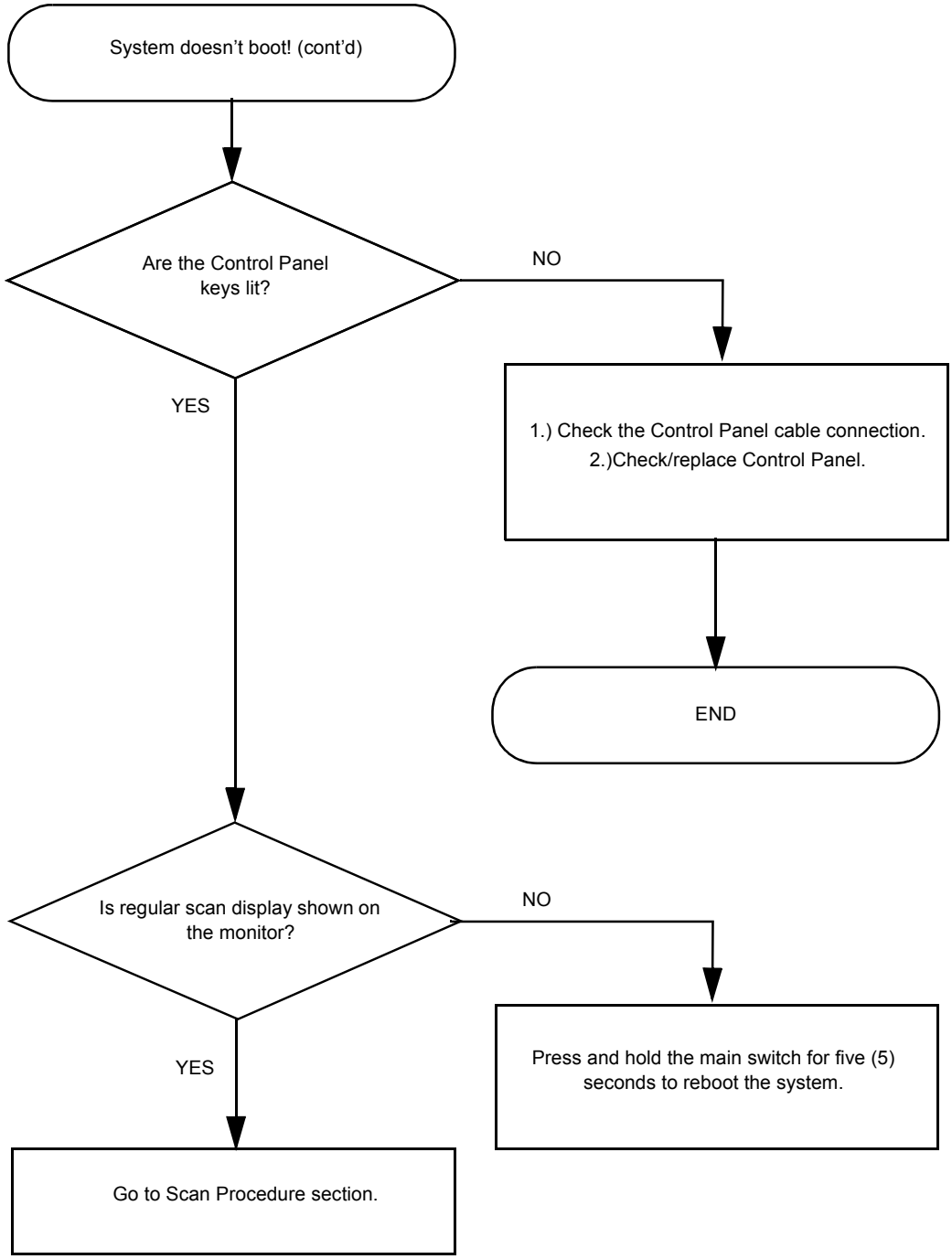

System doesn't boot! (cont'd)
Are the Control Panel keys lit?
NO
YES
1.) Check the Control Panel cable connection.
2.)Check/replace Control Panel.
END
Is regular scan display shown on the monitor?
NO
YES
Press and hold the main switch for five (5) seconds to reboot the system.
Go to Scan Procedure section.

Figure 7-63 System Doesn't Boot (cont'd)

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Chapter 8
Replacement Procedures

Section 8-1
Overview

8-1-1 Purpose of Chapter 8

This chapter holds replacement procedures for the following modules/subsystems.

Table 8-1 Contents in Chapter 8

Section	Description	Page Number
8-1	Overview	8-1
8-2	Plastic Parts Replacement Procedures	8-2
8-3	SW Loading Procedure	8-9
8-4	FRU Replacement Procedures	8-31

8-1-2 Warnings

⚠ **WARNING** ***AT LEAST TWO PERSONS ARE NEEDED WHEN REPLACING HEAVY PARTS LIKE THE MONITOR, THE FROGLEG AND THE AC TRANSFORMER.***

⚠ **WARNING** ***AT LEAST TWO PERSONS ARE NEEDED WHEN REPLACING CASTERS (WHEELS) OR ADJUSTING BRAKES.***

Section 8-2
Plastic Parts Replacement Procedures

8-2-1 Overview of Covers and Bumpers

8-2-1-1 Preparations

Shut down the system as described in "Power Shut Down" on page 4-5.

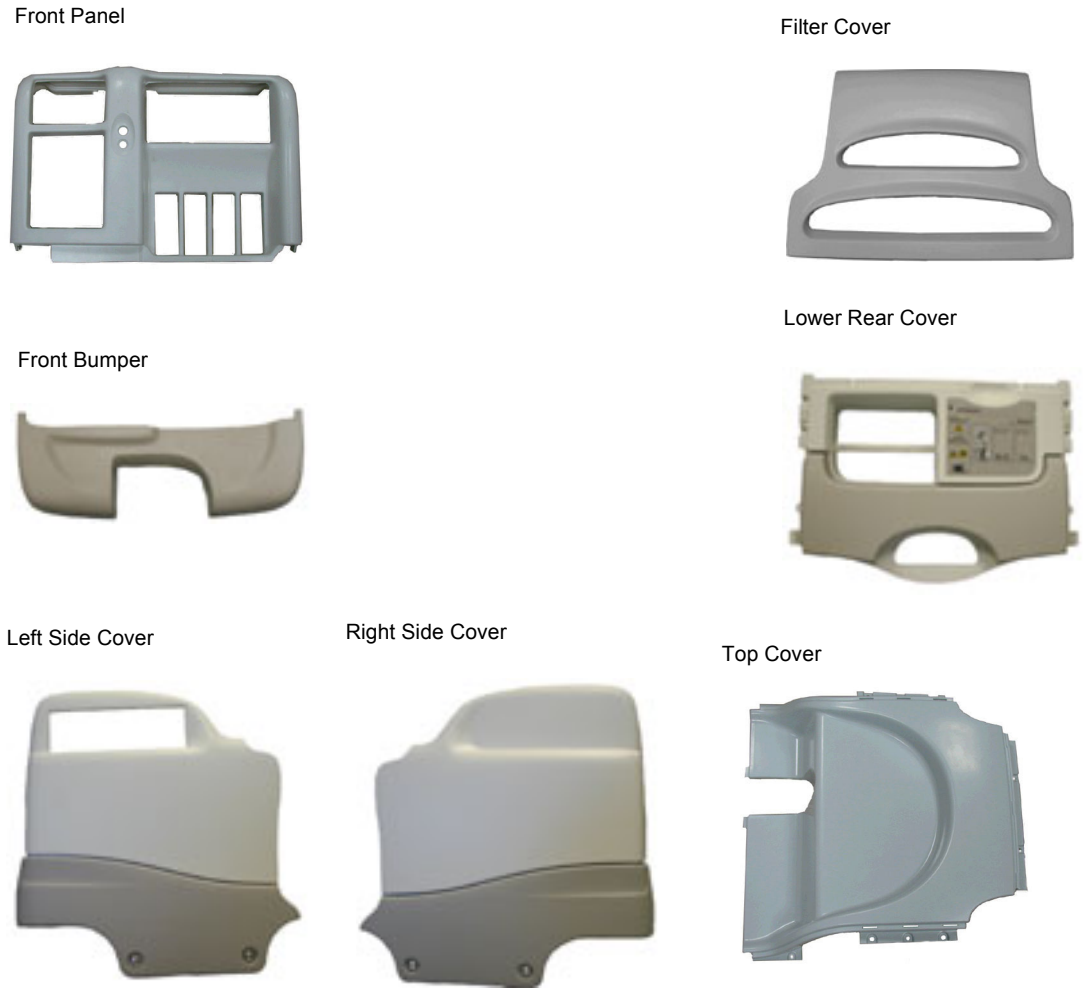


Figure 8-1 Plastic parts

8-2-1-2 Order of removal is:

1.) Side Covers.
2.) Filter Cover.
3.) Top Cover (fastened by screws).
4.) Lower Rear Cover (Screws).
5.) Front Cover (fastened by screws at each side).

8-2-2 Side Covers Replacement Procedure

8-2-2-1 Manpower

One person, 15 minutes

8-2-2-2 Tools

No special tools needed

8-2-2-3 Preparations

Shut down the system as described in "Power Shut Down" on page 4-5.

8-2-2-4 Side Covers Removal Procedure

1.) Turn two (2) recessed fasteners a quarter turn either way with a coin. They clicks loose.
2.) Take hold under the lower front side of cover and pull gently. At the same time support the rear side of the cover with the other hand.
3.) When the cover get loose in front, it's easy to pull free at the rear side and move upwards.

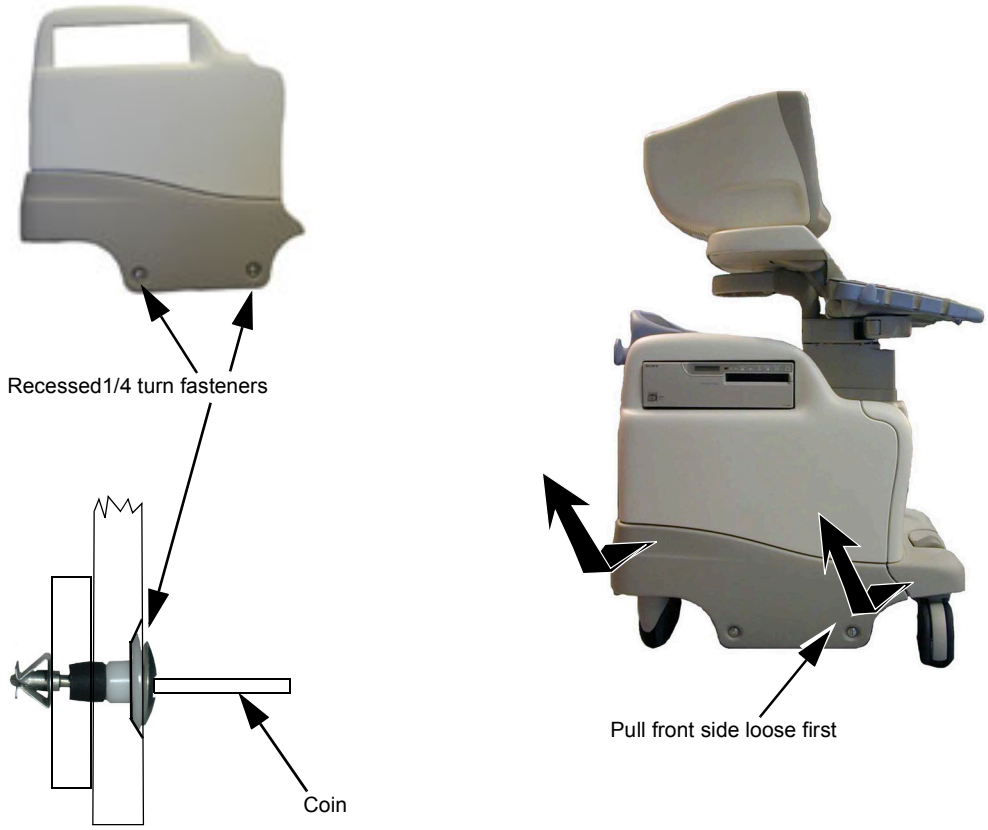


Figure 8-2 Side Covers with fastener overview.

8-2-2-4 Side Covers Removal Procedure (cont'd)

4.) Lift Side Cover gently upwards until the three hooks are free from Top Cover Retainer (See Figure 8-3).

5.) To Remove Left side cover, repeat this procedure.

8-2-2-5 Side Covers Installation Procedure

1.) Guide hooks at the top of Side Cover into their slots in Top Cover (See Figure 8-3).

2.) Install Side Cover. Push rear side first in position locked in Lower Rear Cover.

3.) Push the front side in position locked in Front Cover.

4.) Turn the 1/4 turn screws until the slot is vertical.

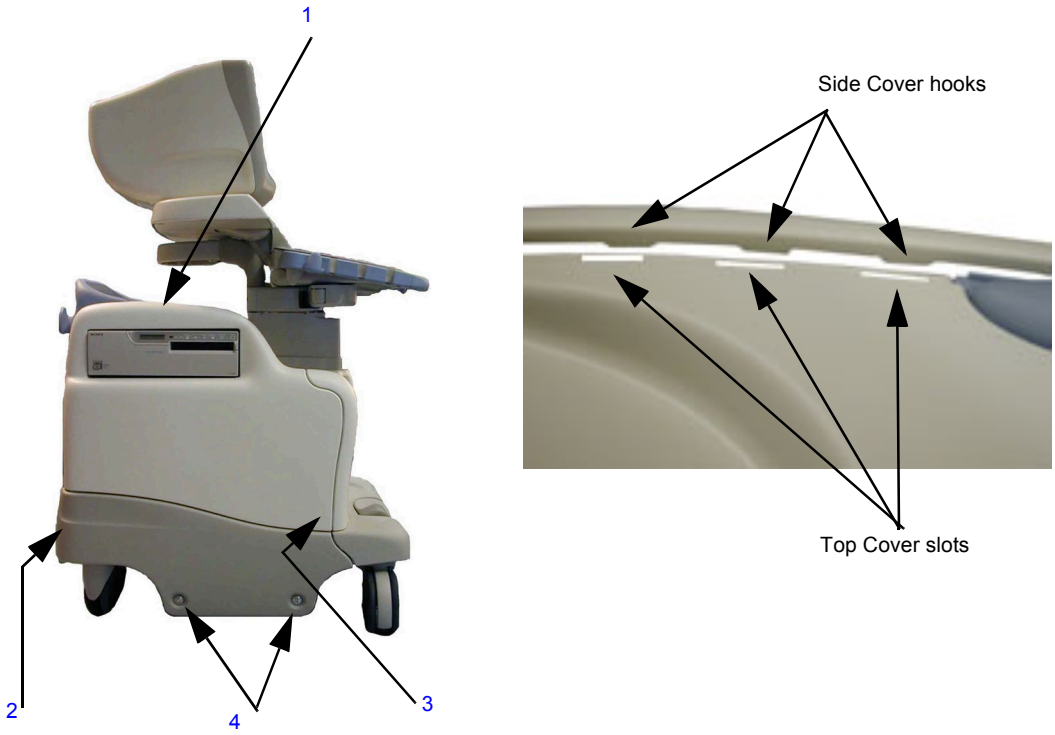


Figure 8-3 Side Cover installment

8-2-3 Front Cover Replacement Procedure

8-2-3-1 Manpower

One person, 30 minutes

8-2-3-2 Tools

Phillips screwdriver

8-2-3-3 Preparations

1.) Shut down the system as described in "Power Shut Down" on page 4-5.
2.) Disconnect all Probes and I/O cabling. See User manual.
3.) Remove Side Covers as described in "Side Covers Removal Procedure" on page 8-3.

8-2-3-4 Front Cover Removal Procedure

1.) Unscrew five (5) Phillips screws that fasten it to the chassis.
2.) Pull it outwards to free it from the Top Cover and Front Bumper (See Figure 8-4).

8-2-3-5 Front Cover Installation Procedure

1.) Thread the same, or a new, cover so it fits in between chassis and bumper (See Figure 8-4).
2.) Thread it so it links together with Top Cover. You may have to loosen two (2) Phillips screws on the top cover that are closest to the Front cover.
3.) Fasten Front Cover with five (5x) Phillips screws.
4.) Fasten two (2x) Phillips screws on Top Cover if these were loosened.
5.) Install Side Covers as described in "Side Covers Installation Procedure" on page 8-4.
6.) New Front Cover: Install correct labels, see "Labels Locations" on page 1-14.

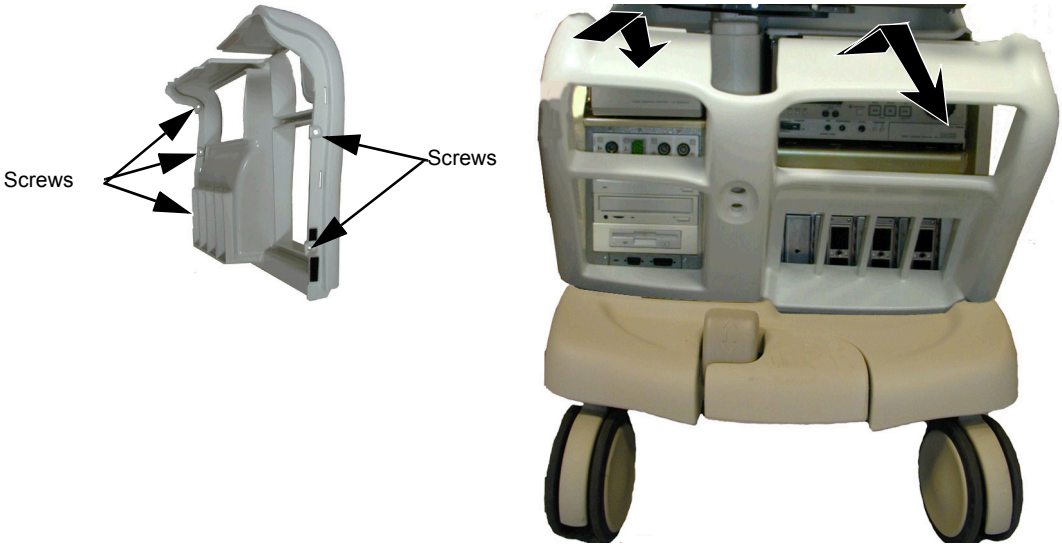


Figure 8-4 Front Cover Replacement

8-2-4 Filter Cover Replacement Procedure

8-2-4-1 Manpower

One person, 5 minutes

8-2-4-2 Tools

No special tools needed

8-2-4-3 Filter Cover Removal Procedure

Take hold at the lower side of Filter Cover and pull it loose from the chassis. Hook it off at the upper side and remove it.

8-2-4-4 Filter Cover Installation Procedure

Align the cover at the upper side and push it into place along its lower side.

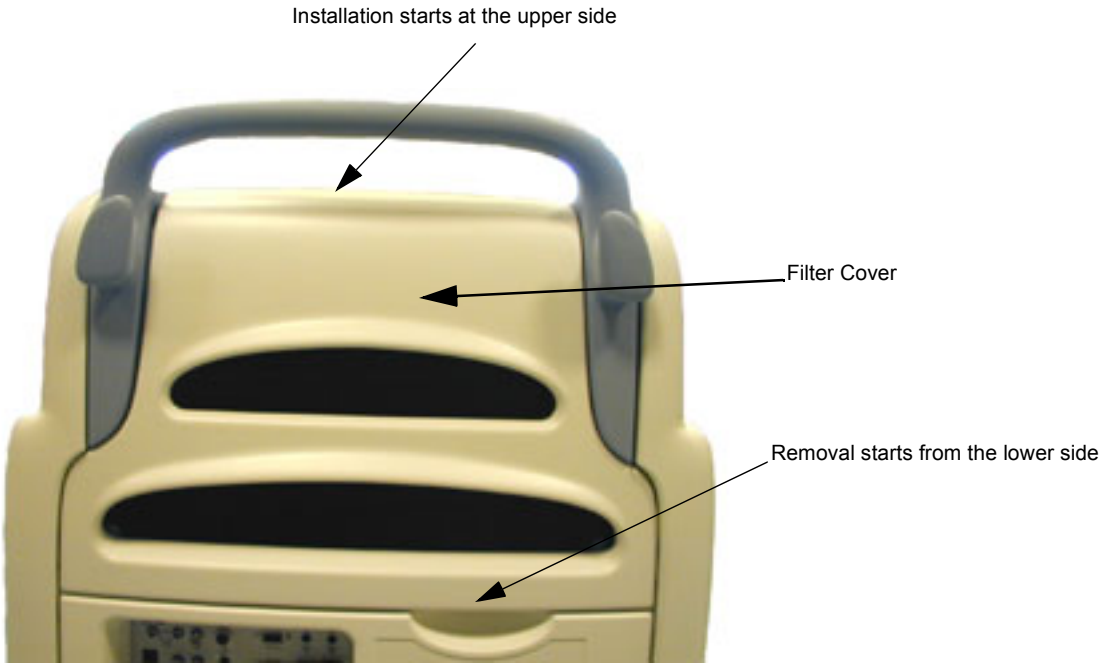


Figure 8-5 Filter Cover

8-2-5 Filter Replacement Procedure

8-2-5-1 Manpower

One person, 30 minutes

8-2-5-2 Tools

No special tools are needed

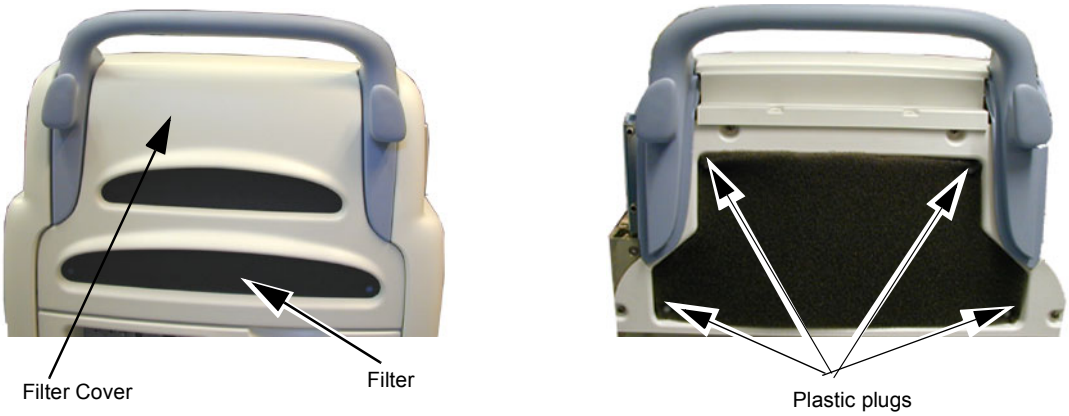


Figure 8-6 Filter Cover and Filter

8-2-5-3 Filter Replacement Procedure

1.) Remove Filter Cover as described in "Filter Cover Removal Procedure" on page 8-6.

2.) Pull out plastic plugs and remove the filter.
Two different Plastic plugs have been used, the one to the left on early Vivid 7 scanners and the type to the right on newer units (both Vivid 7 and Vivid 7 PRO).

3.) Install a new or a cleaned filter (GE Vingmed Part No: FB307903).
Use plastic plugs shown to the right (GE Vingmed Part No: 080X6520)



Figure 8-7 Plug replacement

4.) Install Filter Cover as described in "Filter Cover Installation Procedure" on page 8-6.

8-2-6 Lower Rear Cover Replacements Procedure

8-2-6-1 Manpower

One person, 30 minutes

8-2-6-2 Tools

Phillips screwdriver size 2

8-2-6-3 Preparations

Shut down the system as described in "Power Shut Down" on page 4-5.

8-2-6-4 Lower Rear Cover Removal Procedure

1.) Remove Filter Cover shown in "Filter Cover Removal Procedure" on page 8-6.
2.) Remove both Side Covers as described in "Side Covers Removal Procedure" on page 8-3.
3.) Unscrew two (2) screws with magnetic lock (part number 080X1200) for Filter Cover. Left screw contains also 3 or 4 washers (080C2053), right screw 5 or 6 washers, depending on thickness of Lower Rear Cover.
4.) Unscrew four (4) remaining Phillips screws that fasten Lower Rear Cover to the chassis (See Figure 8-4).
5.) Remove Lower Rear Cover.

8-2-6-5 Lower Rear Cover Installation Procedure

1.) Align Lower Rear Cover with the chassis and fasten it with eight (8) Phillips screws.
2.) Install Filter Cover as described in "Filter Cover Installation Procedure" on page 8-6 and Side Covers as described in "Side Covers Installation Procedure" on page 8-4.
3.) New Lower Rear Cover: Install correct label, see "Labels Locations" on page 1-14.

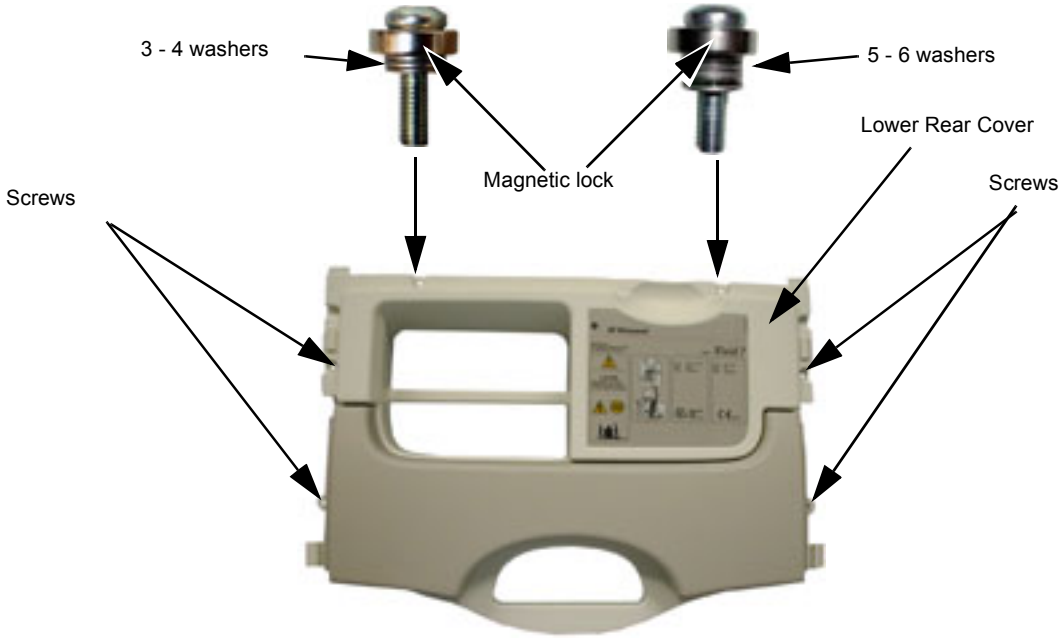


Figure 8-8 Lower Rear Cover Fastening Locations.

Section 8-3
SW Loading Procedure

NOTICE In order to complete a successful restore of the database, the images must be moved to MO disks before doing backup of Patient Database. If the backup procedure is not completed correctly, the images and database information could be lost.

NOTICE Do not use this procedure when upgrading a unit from BT'01 to BT'02 sw. level. Additional sw, not described here, is needed for such upgrades.

8-3-1 Introduction

This procedure describes how to perform a complete installation of the software on the Vivid 7 / Vivid 7 PRO's hard disk. This procedure is included in case it should be necessary to reinstall the present software.

Before installation, moving patient images, backup of customer presets and Patient Database to MO disks, must be completed.

TCP/IP addresses, computer name and software option password settings must be manually recorded.

The backup procedure will move all images from the internal hard disk to a removable MO disk. It will also save the Patient Archive, Report Archive, System Configuration and User Defined Configuration to a backup MO disk.

Table 8-2 Sub-sections in this Procedure

Section	Description	Page Number
8-3-1	Introduction	8-9
8-3-2	Customer Provided Prerequisite	8-9
8-3-3	Tools Provided With Unit or After a Software Upgrade	8-9
8-3-4	Preparation	8-11
8-3-5	Prepare MO Disks for Image Storage	8-12
8-3-6	Move Images	8-13
8-3-7	Prepare MO Disk for Patient Archive	8-15
8-3-8	Backup of Patient Database and User Presets	8-16
8-3-9	Recording of SW Option Keys, TCP/IP and Service Settings	8-18
8-3-10	Software Installation	8-24

8-3-2 Customer Provided Prerequisite

- Formatted and labelled MO Disks for Images storage
- Formatted and labelled MO Disk for Patient Archive and User defined settings.

8-3-3 Tools Provided With Unit or After a Software Upgrade

Table 8-3 CDs with BT'02-M4 Software, SW v.2.2.0

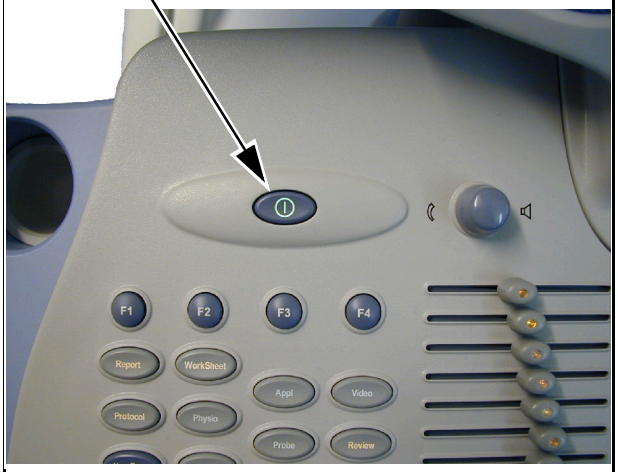
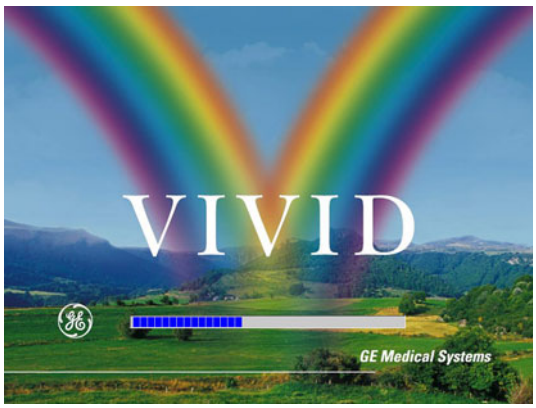
ITEM	TITLE	PART NUMBER	DESCRIPTION
1	V7 SYSTEM SW CD, BEP-1	FC200165-04	Used for complete software installation
2	V7 SYSTEM SW CD, BEP-2	FC200265-03	Used for complete software installation
4	VIVID 7 & ECHOPAC PC APPL. SW	FC200220-xx	Common CD for Vivid 7 / Vivid 7 PRO and EchoPAC PC FC200220-01 is used for sw. 2.0.0 (BT02-M3) FC200220-02 is used for sw. 2.0.1 (L/R fix) FC200220-03 is used for sw. 2.1.0 (BT02-M4-1) FC200220-04 is used for sw. 2.2.0 (BT02-M4-2)

Table 8-4 CDs with BT'01 Software, SW. v.1.x.x

ITEM	TITLE	PART NUMBER	DESCRIPTION
1	Vivid 7, System SW installation CD, Disk 1 of 2	FC200165-01 or FC200027-02	Used for complete software installation. - FC200165-01 is used for software v.1.0.1, v.1.1.0, v.1.1.1 and v.1.1.2 - FC200027-02 is used for software v.1.0.0
2	V7 SYSTEM SW UPGRADE CD	FC200168-02	Used for update of C Drive when updating from BT01-M3 to BT01-M4
3	Vivid 7/EchoPAC PC, Application SW Installation CD, Disk 2 of 2	FC200090-xx	- FC200090-01 is used for software v.1.0.0 - FC200090-02 is used for software v.1.0.1 - FC200090-03 is used for software v.1.1.0 - FC200090-04 is used for software v.1.1.1 - FC200090-05 is used for software v.1.1.2 - FC200090-06 is used for software v.1.1.3

8-3-4 Preparation

Table 8-5 Turn the System ON

Step	Task	Expected Result(s)
1.	Switch ON the Mains Power Circuit Breaker at the rear of the System. Mains Power Circuit Breaker on 	You will hear a “click” from the relays in the AC Power/AC Controller. The system is ready for Boot Up.
2.	Press **ON/OFF** key on the Control Panel (Keyboard) once. **ON/OFF** key 	1). System’s ventilation fan starts on full speed, but slows down after a few seconds (listen to the fan noise). 2). Power is distributed to the peripherals, Control Panel, Monitor, Card Rack and Backend Processor. 3). Backend Processor and rest of Scanner starts with the following sequence: 4). Backend Processor is turned ON and starts to load the software. 5). The Start Screen (Vivid) is displayed on the monitor 6). A start-up bar is displayed on the monitor, indicating the progress of the software loading. 

8-3-5 Prepare MO Disks for Image Storage

1.) Label the MO Disk sequentially.i.e Image 1A (Side A), Image 1B (side B), Image 2A etc.

NOTE: When formatting the MO disk, give it a logical name and make sure to physically label the disk. A labelling convention should be followed so that each MO disk gets a unique label. The maximum numbers of label characters allowed is 11.
MO Disk Label side B must differ from side A.

2.) If the MO Disks is already formatted and labelled move to section 8-3-6 on page 8-13.
3.) Insert a MO disk, side A, into the empty MO drive.
4.) Press **CONFIG** (F2) on the alphanumeric Keyboard on the operator panel.
5.) From the Operator Login window select *adm* from the Operator pull-down menu.
6.) Select LOG ON.
7.) Select CONNECTIVITY in the Image and Analysis menu.
8.) Select TOOLS in the Connectivity menu.
9.) In the Label window, type the same name as labelled on the MO disk side A.
10.) Select FORMAT.

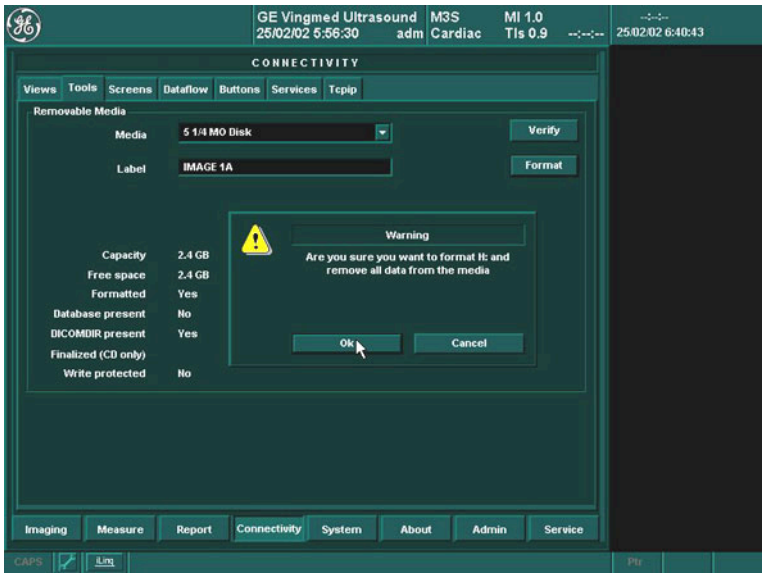


Figure 8-1 Prepare MO Disk - Image Storage

11.) A warning “Are you sure you want to format H: and remove all data from the media” appears, select OK.
12.) Wait until the information dialogue window appears on screen.
13.) Select OK to continue.
14.) Verify the disk formatting status has been updated.
15.) Press **ALT-E.**
16.) Select the *5 1/4 MO Disk*, to eject Disk.
17.) Insert the MO disk, side B and Repeat step 9 to 16.

8-3-6 Move Images

The *Move Images* function enables the movement of archived images from one volume/media to another and the deletion of the moved images from the original volume. The pointers to the database are restored in the new volume/media.

This function copies image data only, no database information is copied.

8-3-6-1 Moving Images from Local Archive to a Removable Media

1.) Insert a formatted MO Disk in the MO Drive.
2.) Press **ARCHIVE** on the Operator Panel.

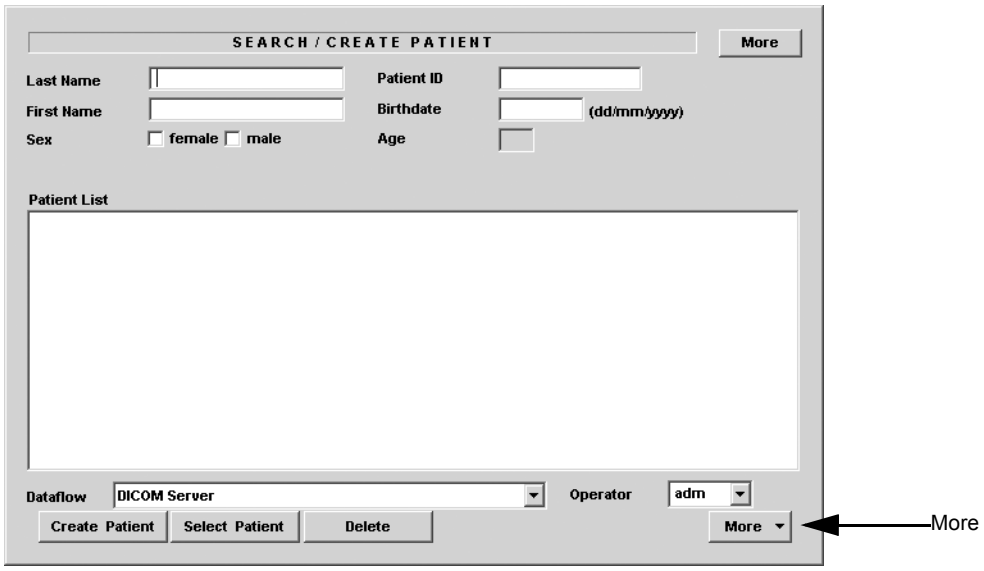


Figure 8-9 Search/Create Patient Window

3.) Select MORE and press **SELECT**.

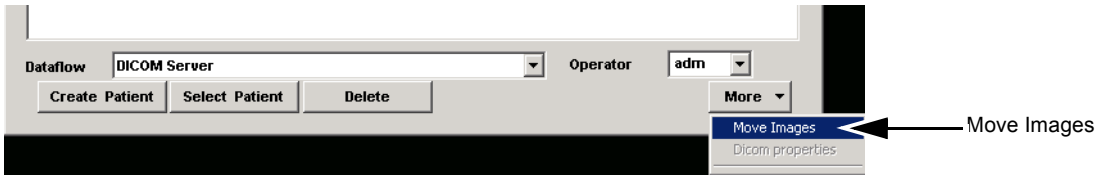


Figure 8-10 Search/Create Patient Window

8-3-6-1 Moving Images from Local Archive to a Removable Media (cont'd)

4.) Select MOVE IMAGES.

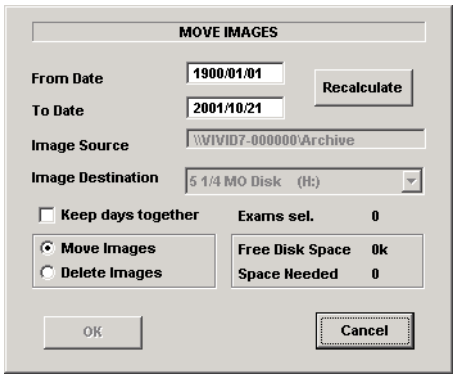


Figure 8-11 The Move Images Window

5.) Adjust **From date** and **To date** to select the images from a defined time period.

6.) If necessary select the actual MO disk in the *Image destination field*.

7.) Check **Keep days together** if images from examinations performed on the same day are to be kept on the same MO disk.

8.) Press RECALCULATE.
The *Free disk space* and *Needed space* information is updated. Make sure that the space needed does not exceed the space available.

*NOTE: If the space needed is bigger than the available space on the destination media the time period selected must be decreased by selecting an earlier date in the **To date field**. Press **recalculate** again and ensure that there is enough space.*

9.) Press OK.
A progress indicator is displayed.

10.) After completion, press OK.

11.) Remove MO-Disk with moved Images from MO-Drive.

12.) In case archive HD exceed MO Disk media capacity;

a.) Insert a new MO-Disk.

b.) Repeat step 5 through 11 as needed.

8-3-7 Prepare MO Disk for Patient Archive

NOTE: A separate MO disk is required for backup of Patient Database, System Configuration and User Defined Configurations (customer presets).
This MO disk must be a new disk with no images stored.

1.) Label the MO Disk sequentially.i.e Backup 1A (side A), Backup 1B (side B).
2.) If the MO Disks is already formatted and labelled move to section 8-3-8 on page 8-16

NOTE: When formatting the MO disk, give it a logical name and make sure to physically label the disk. A labelling convention should be followed so that each MO disk gets a unique label. The maximum numbers of label characters allowed is 11.
MO Disk Label side B must differ from side A.

3.) Insert a MO disk, side A, into the empty MO drive.
4.) Select **CONFIG** (F2) on the alphanumeric Keyboard on the operator panel.
5.) From the Operator Login window select ADM from the Operator pull-down menu.
6.) Select LOG ON.
7.) Select CONNECTIVITY in the Image and Analysis menu.
8.) Select TOOLS in the Connectivity menu.
9.) In the Label window, type the same name as labelled on the MO disk side A.
10.) Select FORMAT.

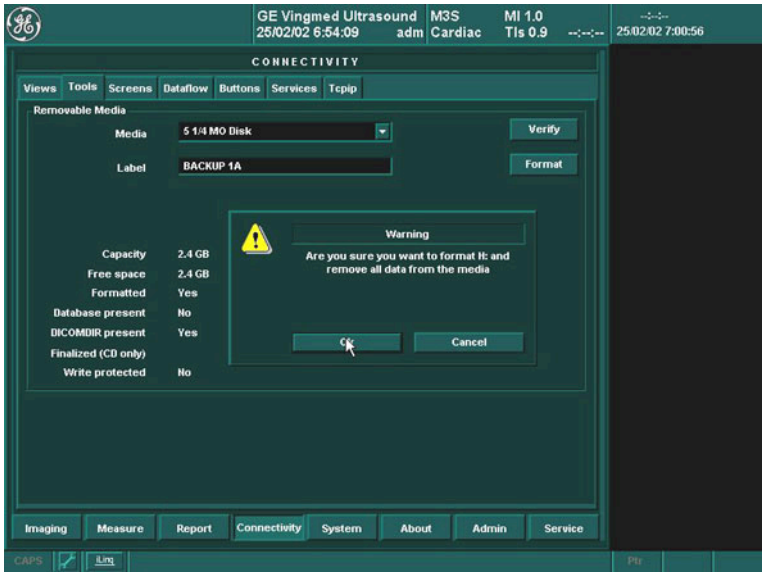


Figure 8-1 Prepare MO Disk - Patient Archive

11.) A warning “Are you sure you want to format H: and remove all data from the media” appears, select OK.
12.) Wait until the information dialogue window appears on screen.
13.) Select OK to continue.

8-3-7 Prepare MO Disk for Patient Archive (cont'd)

14.) Verify the disk formatting status has been updated.

15.) Press **ALT-E.**

16.) Select the *5 1/4 MO Disk*, to eject Disk.

17.) Insert the MO disk, side B and repeat step 9 to 16.

8-3-8 Backup of Patient Database and User Presets

This procedure describes how to backup Patient database and user presets (user defined configuration).

1.) Insert a formatted MO disk prepared for Backup in the MO Drive.

2.) Go to **CONFIG** -> ADMIN -> BACKUP.

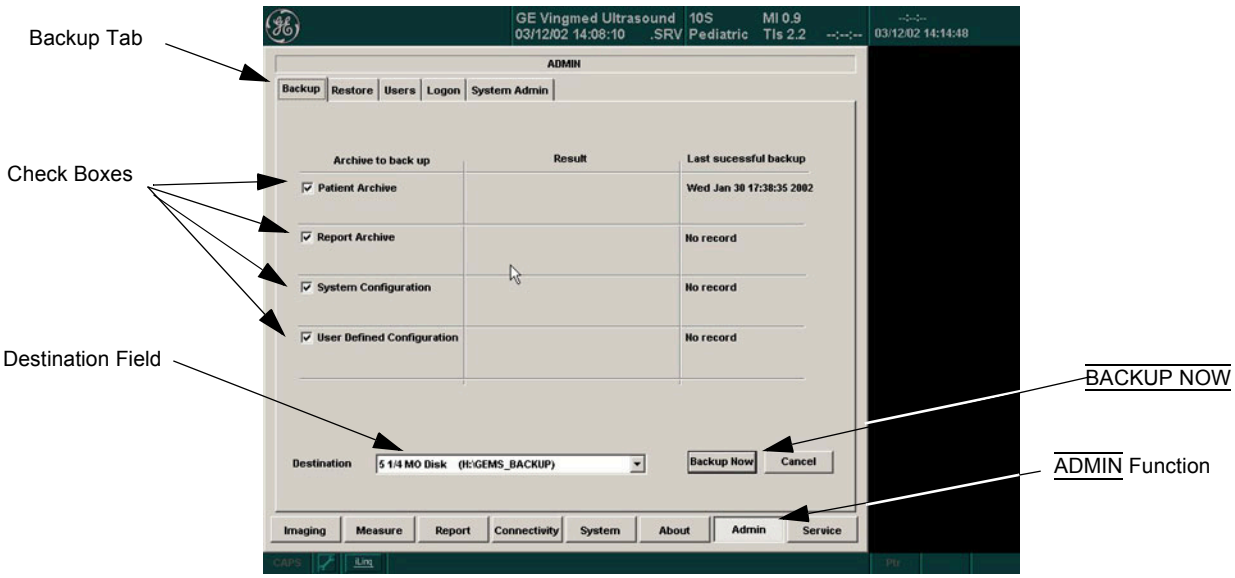


Figure 8-12 The Backup Screen

3.) Select all check boxes.

4.) In the Destination field, select the *MO disk* from the drop-down menu.

5.) Select BACKUP NOW. A Warning will appear on the screen.

8-3-8 Backup of Patient Database and User Presets (cont'd)

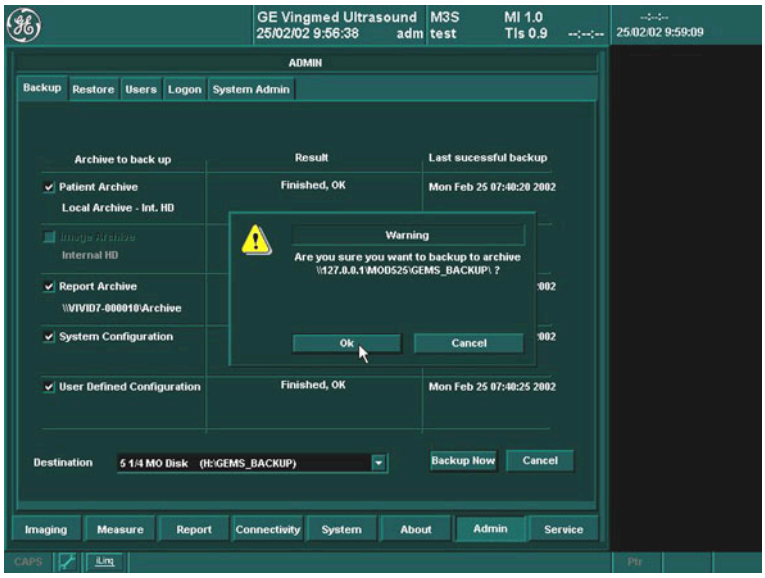


Figure 8-13 Backup Warning

NOTE: No process indicator will appear on screen. Verify that the "Finished, OK" Status appears in the Result column, and that the date appearing in the Last Successful Backup column is the current date and time. The backup is completed.

6.) Remove the Backup MO Disk when the backup is completed.

8-3-9 Recording of SW Option Keys, TCP/IP and Service Settings

NOTE: Service Key is not required and should NOT be installed prior to Upgrade.

8-3-9-1 Record SW Option Keys

1.) Select **CONFIG** (F2) on the alphanumeric Keyboard on the operator panel.
2.) From the Operator Login window select *adm* from the Operator pull-down menu.
3.) Select LOG ON.
4.) From ADMIN tab, select the SYSTEM ADMIN.

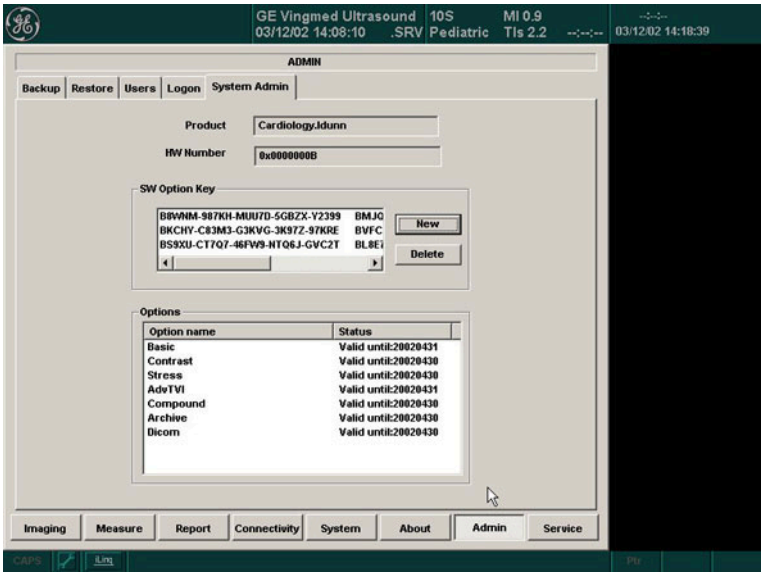


Figure 8-1 System Admin

5.) Record SW Options Keys from SW Options Key window.

⚠ **WARNING** ***Make sure that the SW Option Keys (passwords) have been recorded correctly. If the key is incorrect, you will not be able to log on after the SW installation has been completed. The password is case sensitive. Hyphens must also be recorded. There may be more than one password.***

Table 8-6 SW Options Keys

SW OPTIONS KEYS

8-3-9-2 Record TCP/IP Settings

1.) Select **CONNECTIVITY**.
2.) Select the **TCPIP** tab.
3.) Record all settings in Table 8-7 on page 8-19.

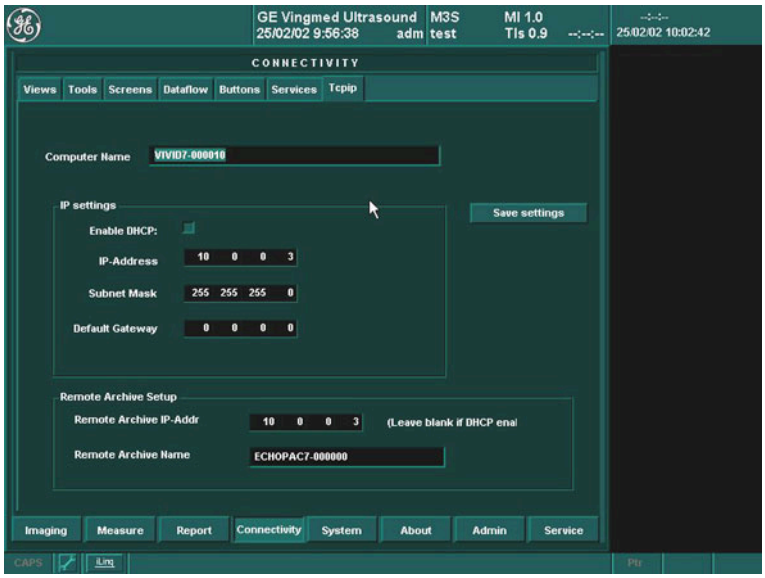


Figure 8-14 TCP/IP Example Settings

Table 8-7 TCPIP Settings Table

FUNCTION	SETTING
Computer Name	
IP-Address	
Subnet Mask	
Default Gateway	
Remote Archive IP-Address	
Remote Archive Name	

8-3-9-3 Record Standard Printer IP and Port Settings

1.) Select CONNECTIVITY.
2.) Select SERVICES.
3.) Scroll down until *Standard Print* appears.
4.) Select *Standard Print*.
5.) Select OPEN.

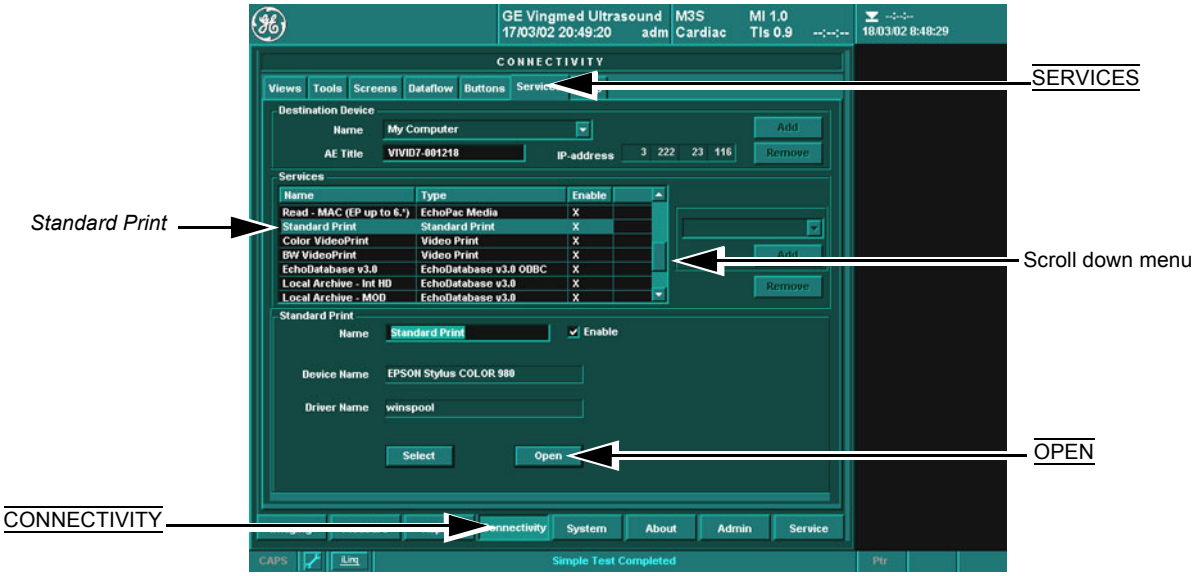


Figure 8-15 Choosing Standard Print

6.) Select *Printer*.
7.) Select *Properties*.

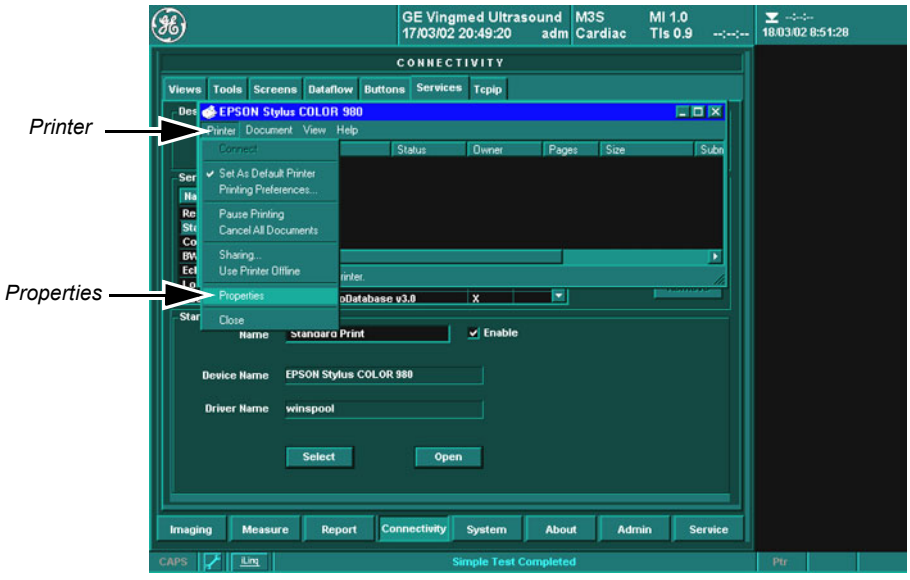


Figure 8-16 Properties

8-3-9-3 Record Standard Printer IP and Port Settings (cont'd)

8.) Select *Standard TCP\IP Port*.

9.) Select CONFIGURE PORT.

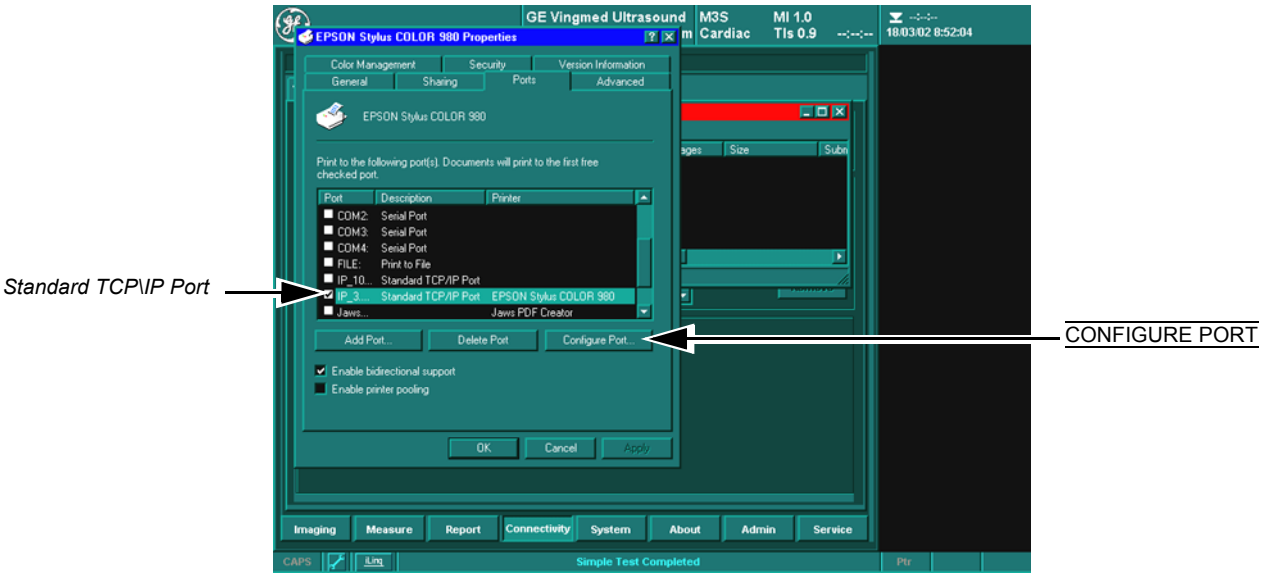


Figure 8-17 Configure Port

10.) Select and record *Printer Name or IP Address* in Table 8-8 on page 8-21.

11.) Select *Raw*.

12.) Select and record *Port Number* in Table 8-8 on page 8-21.

Table 8-8 Printer Name or IP Address and Port Number

Printer Name or IP Address	Port Number

13.) Select OK.

8-3-9-3 Record Standard Printer IP and Port Settings (cont'd)

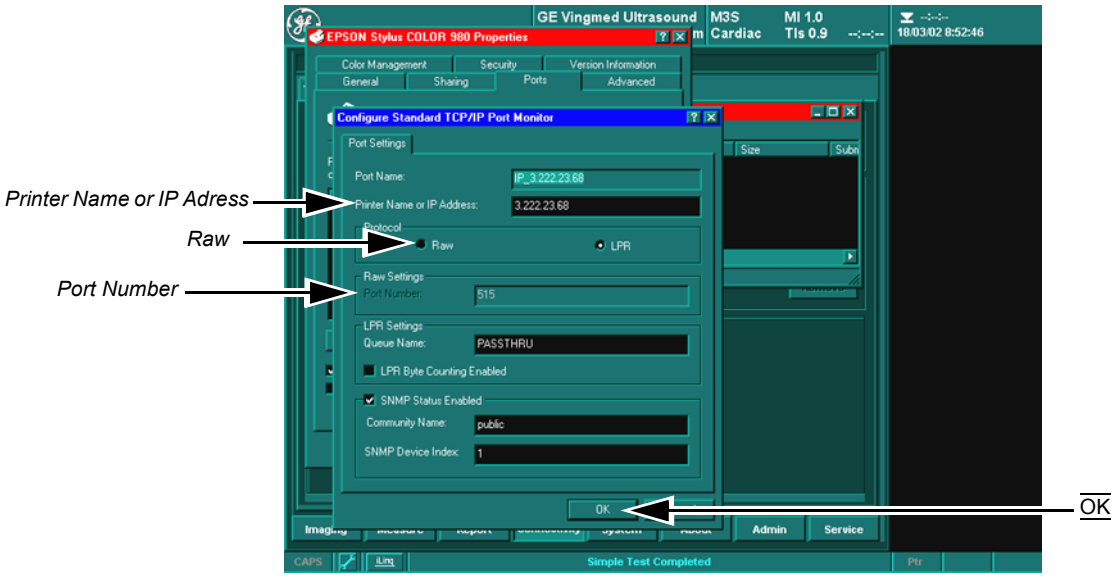


Figure 8-18 Configure Port

14.) Close rest of the Windows by selecting OK.

8-3-9-4 Record Service Settings

1.) Select SERVICE .

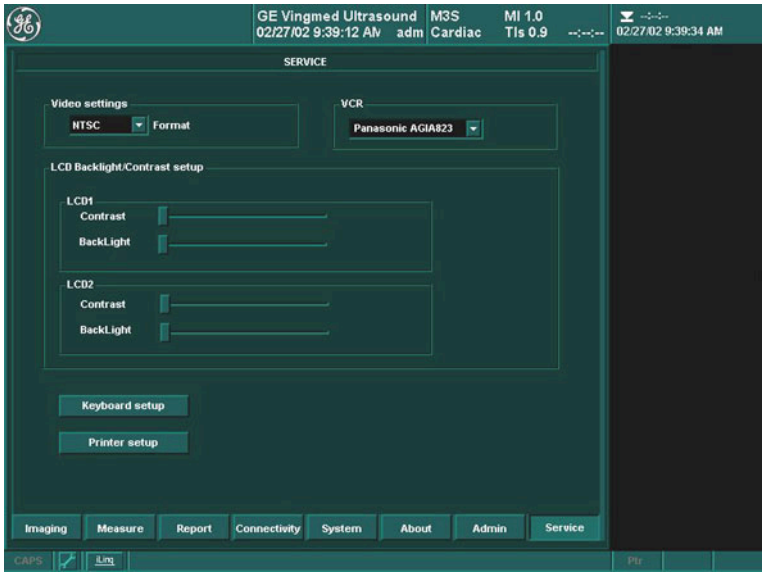


Figure 8-19 Service Settings

2.) Record Video Setting Format and VCR Type in Table 8-9 on page 8-23 .

Table 8-9 Video table

Video Setting Format	VCR Type

3.) Select the ABOUT tab.

4.) Record System Software version in Table 8-10 on page 8-23 .

Table 8-10 System Software version.

System Software version

8-3-10 Software Installation

NOTE: This software installation procedure covers both installation of BT'01 software (SW.v.1.x.x) on Vivid 7 units and installation of BT'02 Software (SW.v.2.x.x) on Vivid 7 / Vivid 7 PRO units.

Table 8-11 Vivid 7 / Vivid 7 PRO Models versus minimum software requirement

GE VINGMED PART NUMBER	DESCRIPTION	SOFTWARE VERSION
FB000030	VIVID 7 (BT'01)	V.1.x.x (or higher)
FC000060	VIVID 7 (BT'01)	V.1.x.x (or higher)
FC000180	VIVID 7 PRO (BT'02)	V.2.x.x
FC000190	VIVID 7 PRO (BT'02)	V.2.x.x
FC000200	VIVID 7 (BT'02)	V.2.x.x
FC000210	VIVID 7 (BT'02)	V.2.x.x

You can also refer to Table 8-10 on page 8-23 where you recorded the unit's software version.

⚠ **NOTICE** When this procedure starts, existing software will be erased. If backup has not been performed as described earlier in this manual; Patient Database, System Configuration and User Configurations (customer presets) will be lost.

8-3-10-1 Vivid 7 / Vivid 7 PRO System SW Installation

1.) Insert the applicable *Vivid 7 SW CD*, according to Table 8-12 on page 8-24, into the CD drive.

Table 8-12 System Software List

SOFTWARE	DESCRIPTION	PART NUMBER
SW. v.2.2.0	Vivid 7 System SW CD (BT'02-M4-2, BEP-2)	FC200265-03
SW. v.2.1.0	Vivid 7 System SW CD (BT'02-M4-2, BEP-1)	FC200165-04
SW. v.1.1.3	Vivid 7 System SW Installation CD (BT'01-M4)	FC200165-01

2.) Power down the System as described in section 4-2-2 on page 4-5.

3.) Wait until the LCD's on the Operator Panel are switched off and the Power Standby Switch has turned yellow.

4.) Power ON the System as described in Table 8-5 on page 8-11.

5.) Wait for the SW Installation to be completed. (Typically installation time: 5 minutes). Status bar on the screen indicates process.

6.) You will now be prompted to remove the first CD and restart the System when the SW Installation is completed. Remove the CD, but **don't restart the System this time**.

8-3-10-2 Application SW Installation

1.) Insert the applicable CD labelled *Vivid7 & EchoPAC PC Application SW*, according to Table 8-13 on page 8-25, into the CD drive.

Table 8-13 Application Software List

SOFTWARE	DESCRIPTION	PART NUMBER
SW. v.2.2.0	Vivid7 & EchoPAC PC Application SW (BT'02-M4-2)	FC200220-04
SW. v.1.1.3	Vivid7/EchoPAC PC Application SW (BT'01-M4)	FC200090-06

2.) Hold down the power switch on the operator panel for a few seconds to power down the scanner (forced shut down).

3.) Wait until the LCD's on the Operator Panel is switched OFF and the Power Switch on the Operator Panel has turned yellow.

4.) Power ON the System as described in Table 8-5 on page 8-11.

5.) A dialogue box, called Start Application, will appear, select INSTALL SW.

6.) A dialogue box, called Startloader, will appear, select OK to continue.

7.) A dialogue box will appear, also named Startloader stating "New System SW installation will start now", select OK to continue.

8.) A Command prompt window will appear, hit any key on the alphanumeric keyboard to continue

9.) A message in the Command prompt window may prompt you that copying application software takes 2 minutes.
THIS WILL TAKE APPR. 5 MINUTES.

10.) Several dialogue boxes will appear on the screen during the SW load.

⚠ **NOTICE** Do not interrupt the SW loading at any time.

11.) Remove the CD from the CD drive when prompted.

12.) The Scanner will now power down and reboot. Verify that the command prompt window is selected.

8-3-10-3 Verify SW Key Option Settings

1.) From the alphanumeric keyboard on the Operator Panel, select **CONFIG** (F2 key), from the operator log in window, select *adm* from the pull down menu, then select LOG ON**.** (No password Needed).

2.) From the bottom of the configuration page select the CONNECTIVITY tab.

3.) From the lower part of the window, select the SERVICE tab.

.

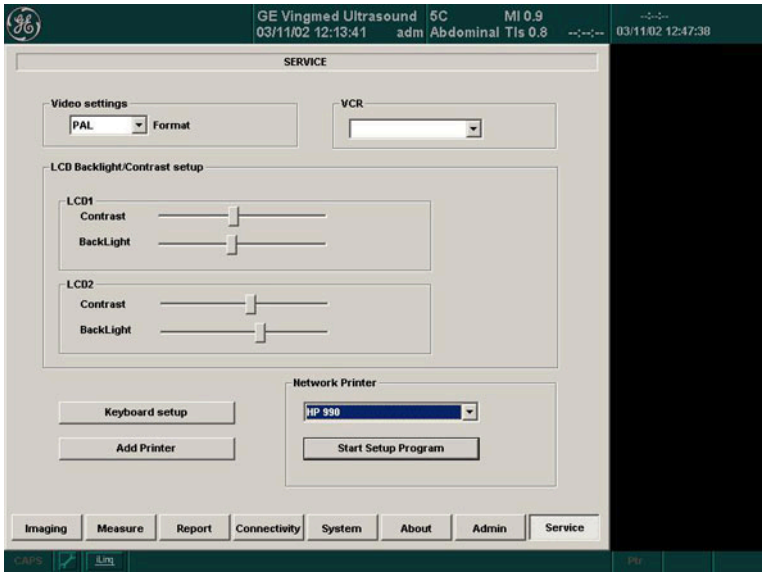


Figure 8-20 Video Settings

4.) From Video Settings pull down menu, verify *Format* as recorded in Table 8-9 on page 8-23 .

5.) From the VCR pull down menu, verify *VCR type* as recorded in Table 8-9 on page 8-23 .

6.) From the top of the connectivity tab, select the TCPIP tab.

8-3-10-3 Verify SW Key Option Settings (cont'd)

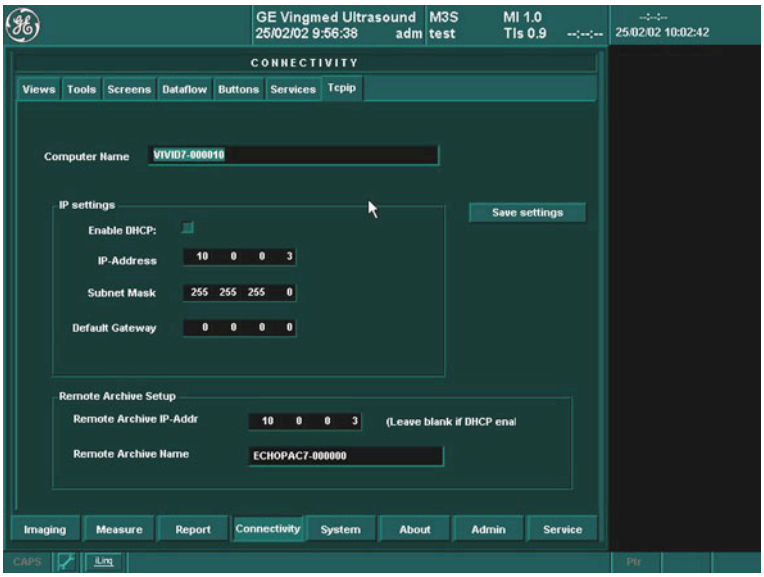


Figure 8-21 TCP/IP Example Settings

7.) Verify that all settings on the TCPIP tab matches those recorded in Table 8-7 on page 8-19 .

8.) Select SAVE SETTINGS.

9.) Select OK to continue.

8-3-10-4 Restore Standard Printer IP and Port Settings

1.) Select CONNECTIVITY.
2.) Select SERVICE.
3.) Select *Standard Print*.
4.) Select OPEN.

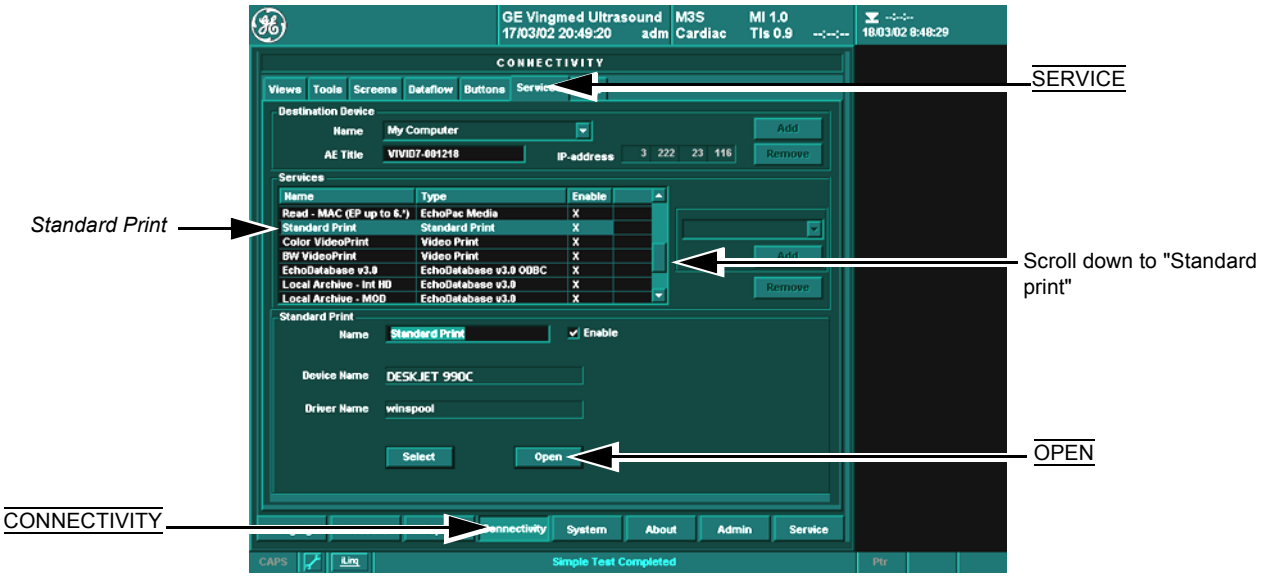


Figure 8-22 Choosing Standard Print

8-3-10-4 Restore Standard Printer IP and Port Settings (cont'd)

5.) Select *Printer*.

6.) Select *Properties*.

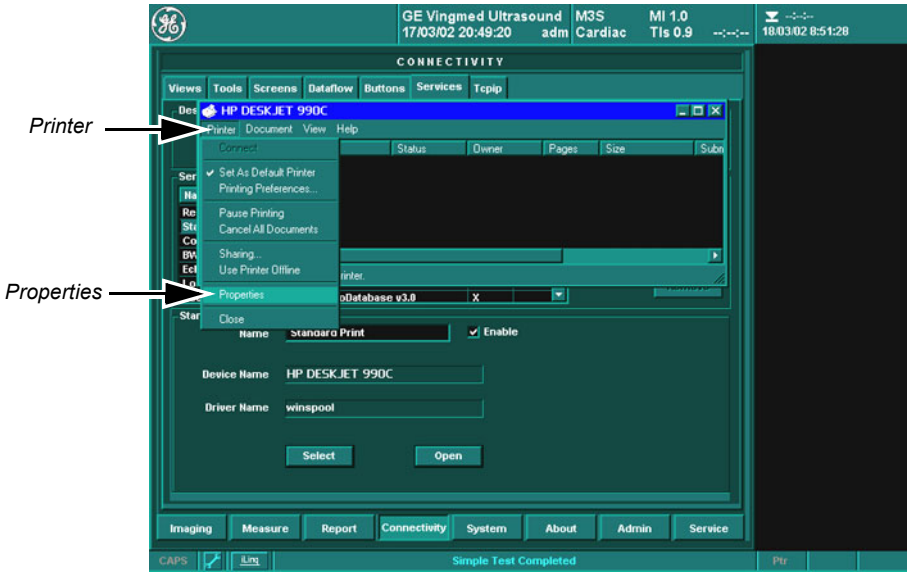


Figure 8-23 Properties

7.) Select *Standard TCP\IP Port*.

8.) Select CONFIGURE PORT.

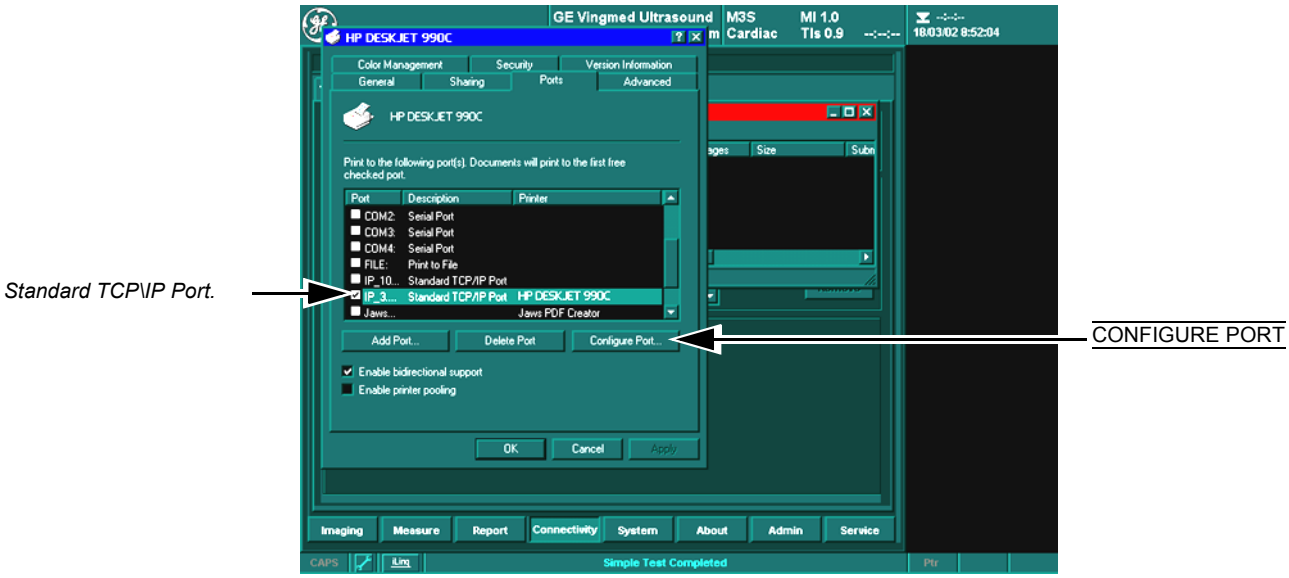


Figure 8-24 Configure Port

8-3-10-4 Restore Standard Printer IP and Port Settings (cont'd)

9.) Verify *Printer Name or IP Address* as recorded in Table 8-8 on page 8-21

10.) Select *Raw*.

11.) Verify *Port Number* as recorded in Table 8-8 on page 8-21.

12.) Select OK.

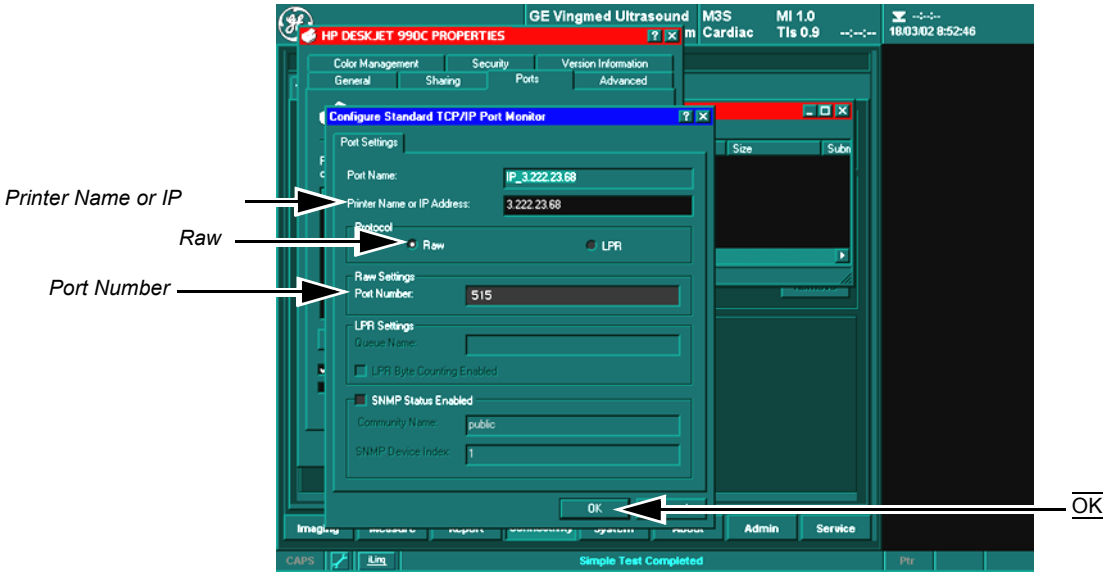


Figure 8-25 Configure Port

13.) Close rest of the Windows by selecting OK.

8-3-10-5 DC Offset Alignment

1.) From the upper section of the window, select TEST.

2.) Then select GO TO SYSTEM TEST.

3.) From the Module selection block, select DC OFFS. CAL.

4.) Reboot the System.

8-3-10-6 Verify System Software Version

1.) From the alphanumeric keyboard on the Operator Panel, select **CONFIG** (F2 key), from the operator log in window, select ADM from the pull down menu, then select LOG ON**.** (No password Needed).

2.) Select ABOUT tab.

3.) Verify that the SW versions is the same as what was recorded in Table 8-10 on page 8-23 .

- Torque wrench (available range: 12 Nm) with 5 mm hexagon bit

4.) Torque wrench with 5 mm hexagon bit to tighten the bolts to 12 Nm.

Section 8-4
FRU Replacement Procedures

8-4-1 AC Transformer Replacement Procedure

8-4-1-1 Manpower

Two persons, 1 hour 30 minutes

8-4-1-2 Tools

- Phillips screwdriver size 2
- Small wire nipper or blade screwdriver
- Metal shears or hack saw

8-4-1-3 Preparations

1.) Shut down the system as described in "Power Shut Down" on page 4-5.

DANGER **Dangerous voltages are present in this equipment. Completely power off and shut down the scanner before servicing.**

2.) Remove Left Side Cover as described in "Side Covers Removal Procedure" on page 8-3.
3.) Remove Filter Cover as described in "Filter Cover Removal Procedure" on page 8-6.
4.) Remove Lower Rear Cover as described in "Lower Rear Cover Removal Procedure" on page 8-8.
5.) Remove five (5) plastic expansion plugs that holds Ratcover. Use a small wire nipper or blade screwdriver.
6.) Turn and bend Ratcover until it can be removed.
7.) Disconnect two cables from AC transformer.

8-4-1-4 AC Transformer Removal Procedure

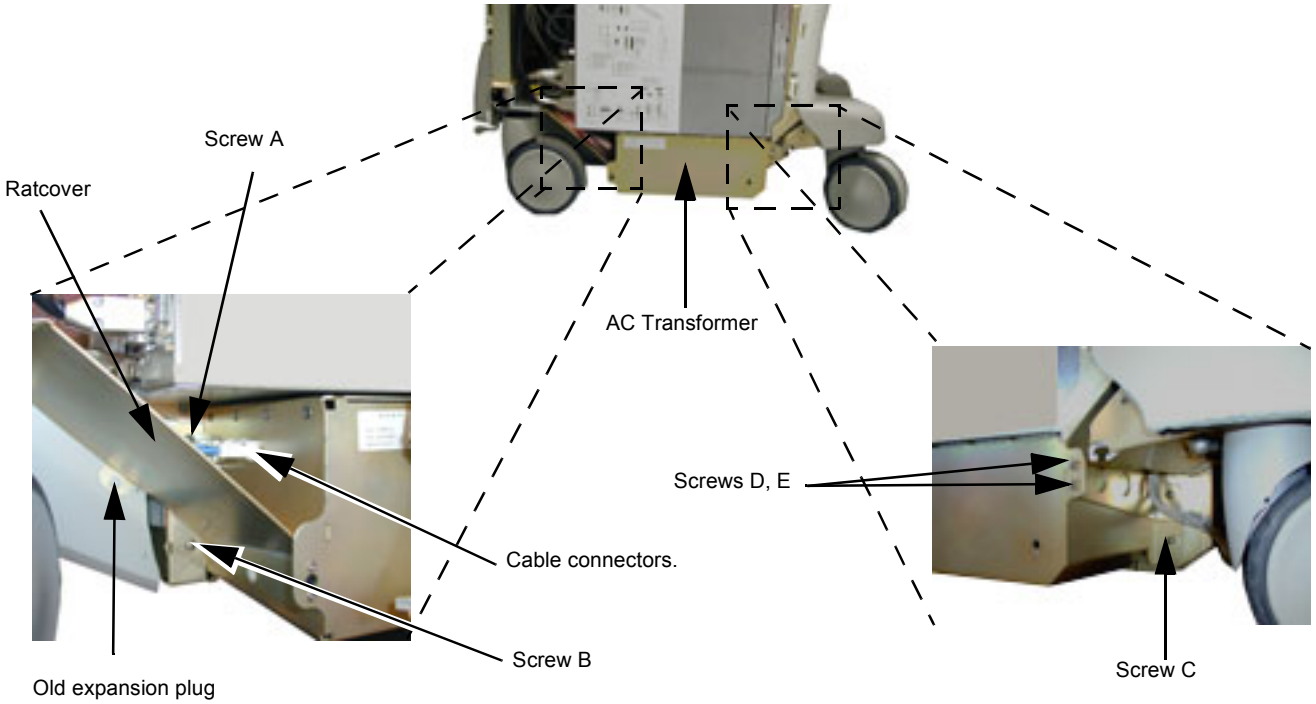


Figure 8-26 AC Transformer

1.) Loosen screw A, B and C (See Figure 8-26) a few turns. Unscrew screw D and E while you hold AC Transformer to prevent it from tilting forwards.
2.) Push AC Transformer to the left, tilt it forwards to free screw keyholes from screw heads (A, B and C) and lift the transformer off hooks along its the lower inner edge.

8-4-1-5 AC Transformer Installation Procedure

1.) Hang the inner lower edge of AC Transformer in its hooks.
2.) Adjust its position so that screw keyholes matches screw heads (A,B and C).
3.) Tilt AC Transformer upwards and push it to the right, screw heads into the keyholes.
4.) Hold it steady while you fasten screw D and E.
5.) Fasten screw A, B and C.
6.) Connect two cables.

8-4-1-5 AC Transformer Installation Procedure (cont'd)

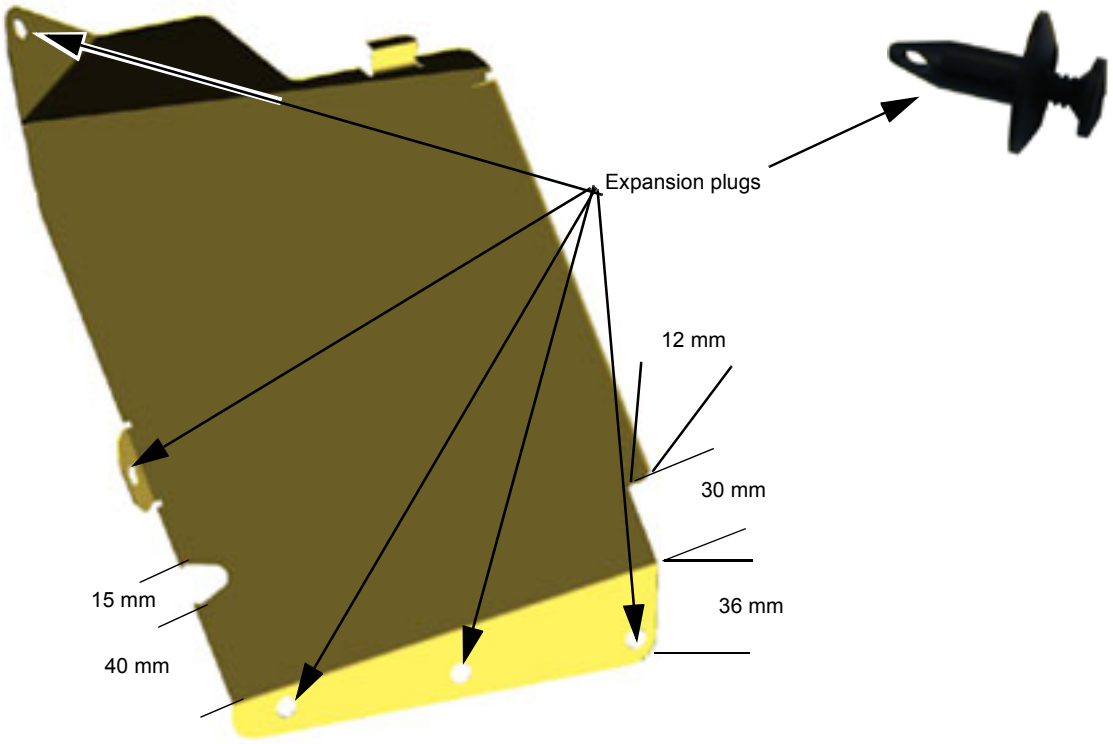


Figure 8-27 Ratcover modification

7.) Compare Ratcover with illustration in Figure 8-27 above. If it is not already done, use a hack saw or metal shears and modify Ratcover according to this illustration.

8.) Install Ratcover.

9.) Secure Ratcover with five (5) new plastic expansion plugs, P/N 080X3141.

10.) Install Lower Rear Cover as described in "Lower Rear Cover Installation Procedure" on page 8-8.

11.) Install Filter Cover as described in "Filter Cover Installation Procedure" on page 8-6.

12.) Install Left Side Cover as described in "Side Covers Installation Procedure" on page 8-4.

13.) Do functional check-out as described in Chapter 4.

8-4-2 AC Power Replacement Procedure

8-4-2-1 Manpower:

One person, 1 hour.

8-4-2-2 Tools:

Phillips screwdriver size 2

DANGER **Dangerous voltages are present in this equipment. Completely power off and shut down the scanner before servicing.**

8-4-2-3 Preparations

1.) Shut down the system as described in "Power Shut Down" on page 4-5.
2.) Remove Right Side Cover as described in "Side Covers Removal Procedure" on page 8-3.
3.) Remove Filter Cover as described in "Filter Cover Removal Procedure" on page 8-6.
4.) Remove Lower Rear Cover as described in "Lower Rear Cover Removal Procedure" on page 8-8.
5.) Note Voltage type of AC Power Module being replaced (see label on rear of system).

8-4-2-4 AC Power Removal Procedure

1.) Disconnect Speed Control cable, Fan cable and Input Voltage cable.
2.) Remove four (4) screws holding AC Power.
3.) Turn AC Power Module to get better access and unplug the rest of the cables. Make sure each connector and socket are properly marked, and easy to identify during installation.

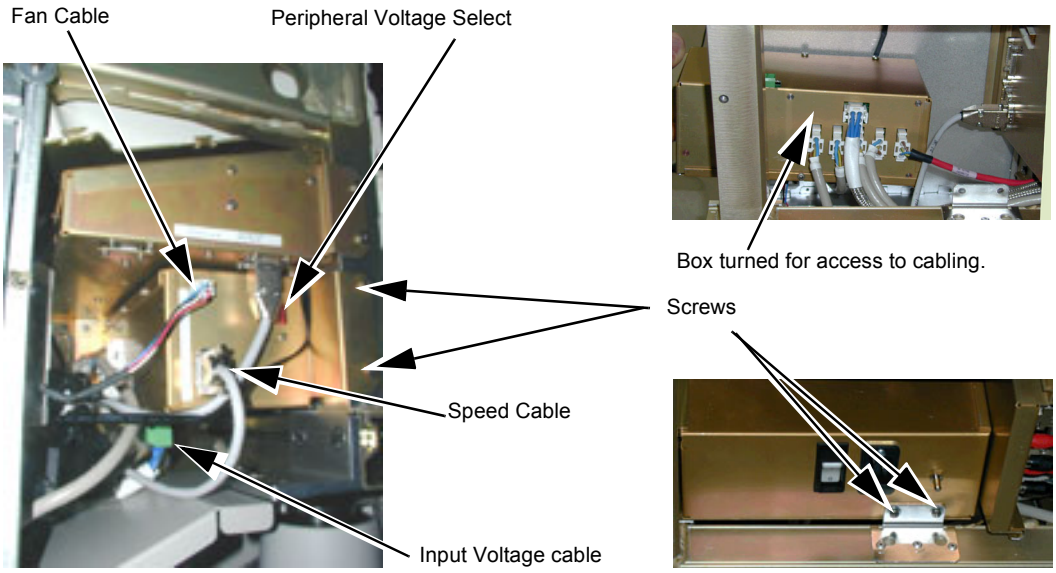


Figure 8-28 AC Power Module

8-4-2-5 AC Power Installation Procedure

DANGER **Before installing a replacement unit, verify that the power selector on the AC Power Module is set to the correct voltage for the peripherals used on the system.**

1.) Connect the cables. You may need to leave the Speed Control cable and the Fan cable unconnected until you have fastened the unit. Input Voltage connector and socket are coded to prevent mistakes. In 115V system the connector matches one end of the 8-holed socket. In 230V system it matches the other end of the socket. Figure 8-29 is on a 230V system, and the connector can only be plugged in the right end of the socket.

2.) Fasten AC Power Module for correct Voltage and connect the remaining cables.

3.) Install Lower Rear Cover as described in "Lower Rear Cover Installation Procedure" on page 8-8.

4.) Install Filter Cover as described in "Filter Cover Installation Procedure" on page 8-6.

5.) Install Right Side Cover as described in "Side Covers Installation Procedure" on page 8-4.

6.) Do functional check-out as described in Chapter 4..

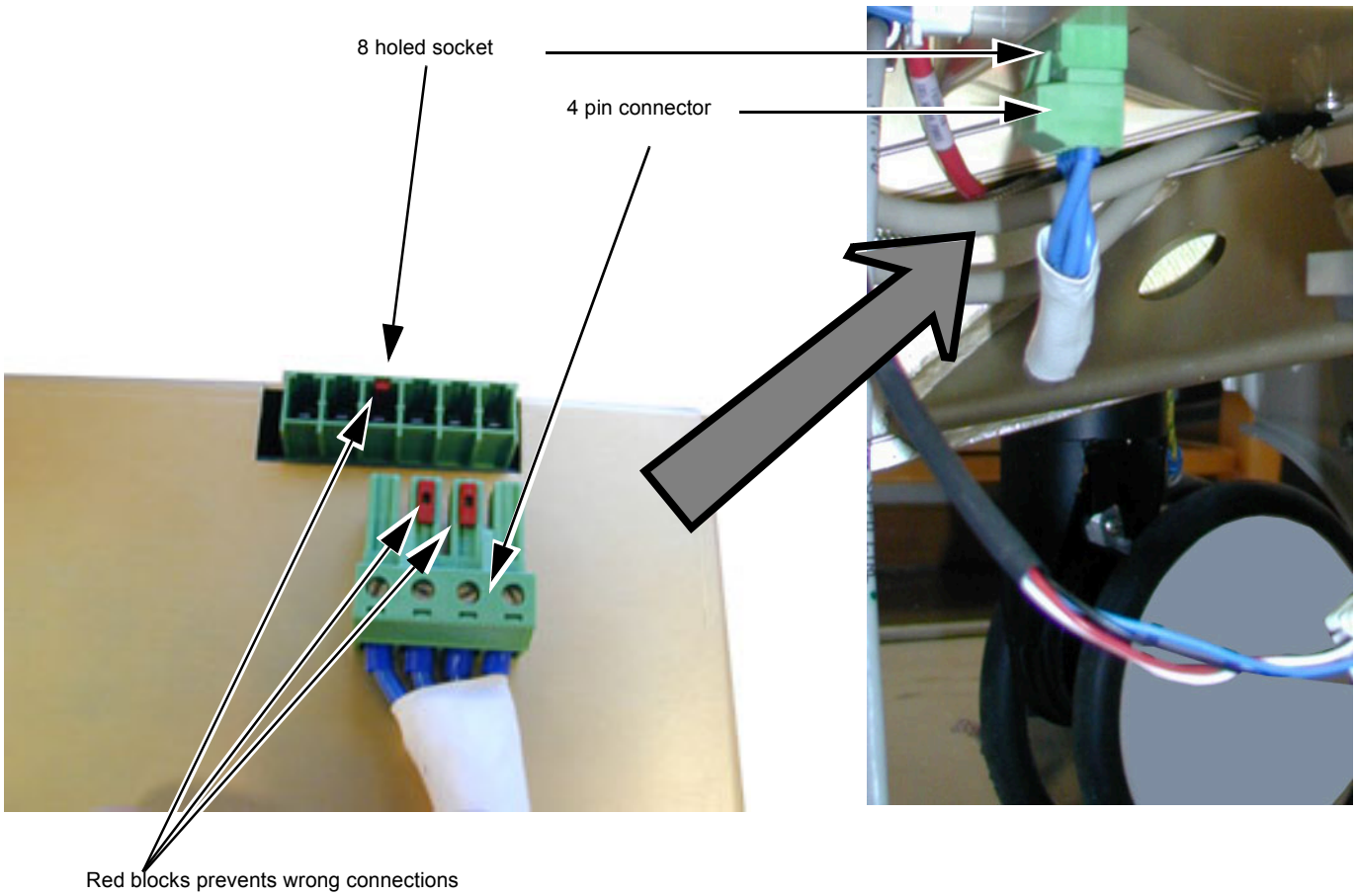


Figure 8-29 Input Voltage connector/socket

8-4-3 DC Power Replacement Procedure

8-4-3-1 Manpower

One person, 30 minutes

8-4-3-2 Tools

4 mm blade screwdriver.

DANGER **Dangerous voltages are present in this equipment. Completely power off and shut down the scanner before servicing.**

8-4-3-3 Preparations

1.) Shut down the system as described in "Power Shut Down" on page 4-5.
2.) Remove Right Side Cover as described in "Side Covers Removal Procedure" on page 8-3.
3.) Remove Card Rack Cover.
   a.) Turn seven (7) quarter-turn screws to loosen Card Rack door.
   b.) Holding the door, lift it out of its retainers along the lower edge of Card Rack.

8-4-3-4 DC Power Removal Procedure

1.) Unscrew three (3) screws as shown in Figure 8-30.
2.) Unplug PCI cable from the socket on IMP2 board.
3.) Pull the DC Power a little to get access to power cables.
4.) Remove retaining clasp and unplug Power Cable and HV Cable.
5.) Remove DC Power.

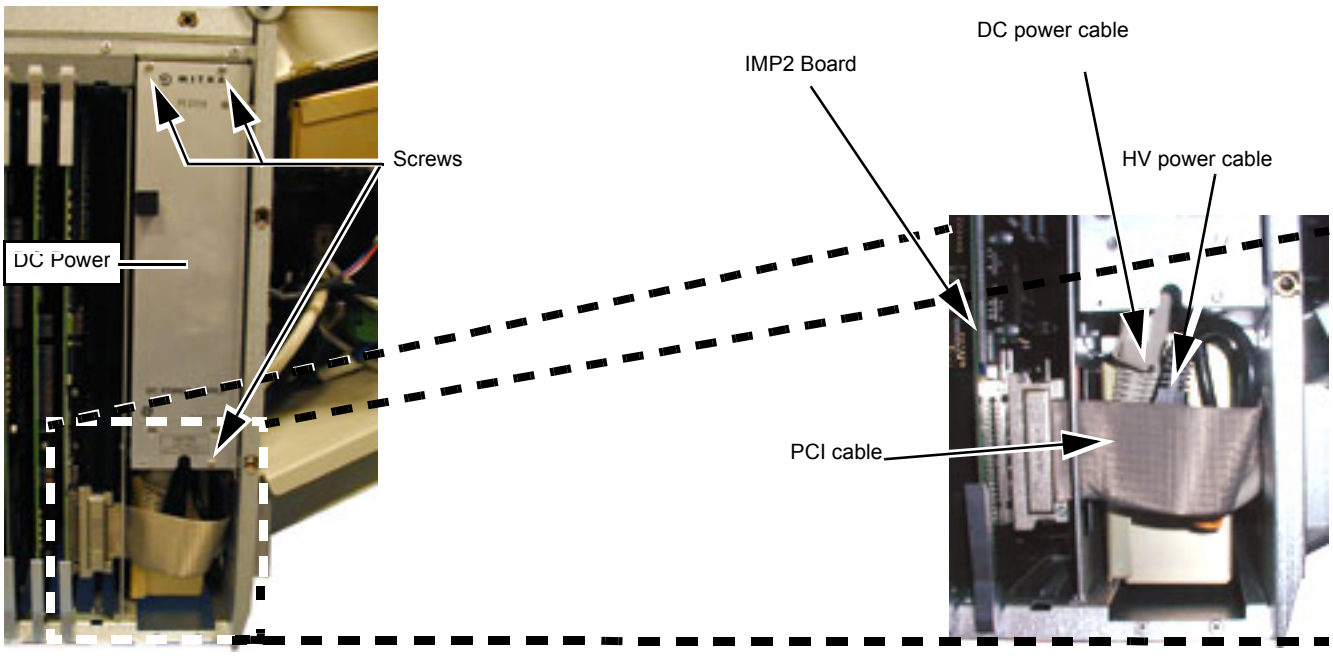


Figure 8-30 DC Power and Cabling.

8-4-3-5 DC Power Installation Procedure

1.) Slide DC Power module into its guides.
2.) Plug in HV cable and Power cable and secure Power cable with the retaining clasp.
3.) Push DC Power module gently in position.
4.) Fasten three (3) screws.
5.) Connect PCI cable to IMP2 Board.
6.) Install Right Side Cover as described in "Side Covers Installation Procedure" on page 8-4.
7.) Install Card Rack Cover.
8.) Do functional check-out as described in chapter 4.

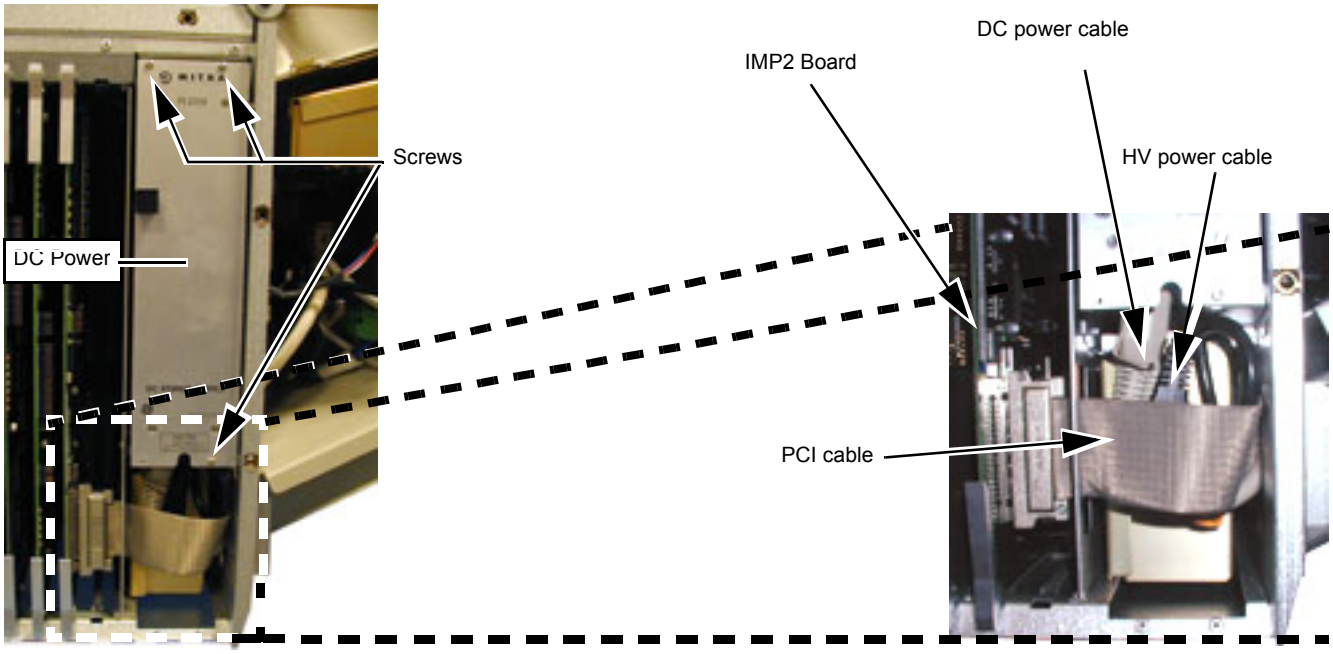


Figure 8-31 DC Power and Cabling.

8-4-4 TX Power Replacement Procedure

8-4-4-1 Manpower:

One person, 30 minutes

8-4-4-2 Tools:

- Phillips screwdriver 2
- 4 mm blade screwdriver

DANGER Dangerous voltages are present in this equipment. Completely power off and shut down the scanner before servicing.

8-4-4-3 Preparations

1.) Shut down the system as described in "Power Shut Down" on page 4-5.
2.) Remove Right Side Cover as described in "Side Covers Removal Procedure" on page 8-3.
3.) Remove the Card Rack Door.
   a.) Turn seven (7) quarter-turn screws to loosen Card Rack door.
   b.) Holding the door, lift it out of its retainers along the lower edge of Card Rack.
4.) Disconnect PCI cable from IMP2 Board shown in Figure 8-32.

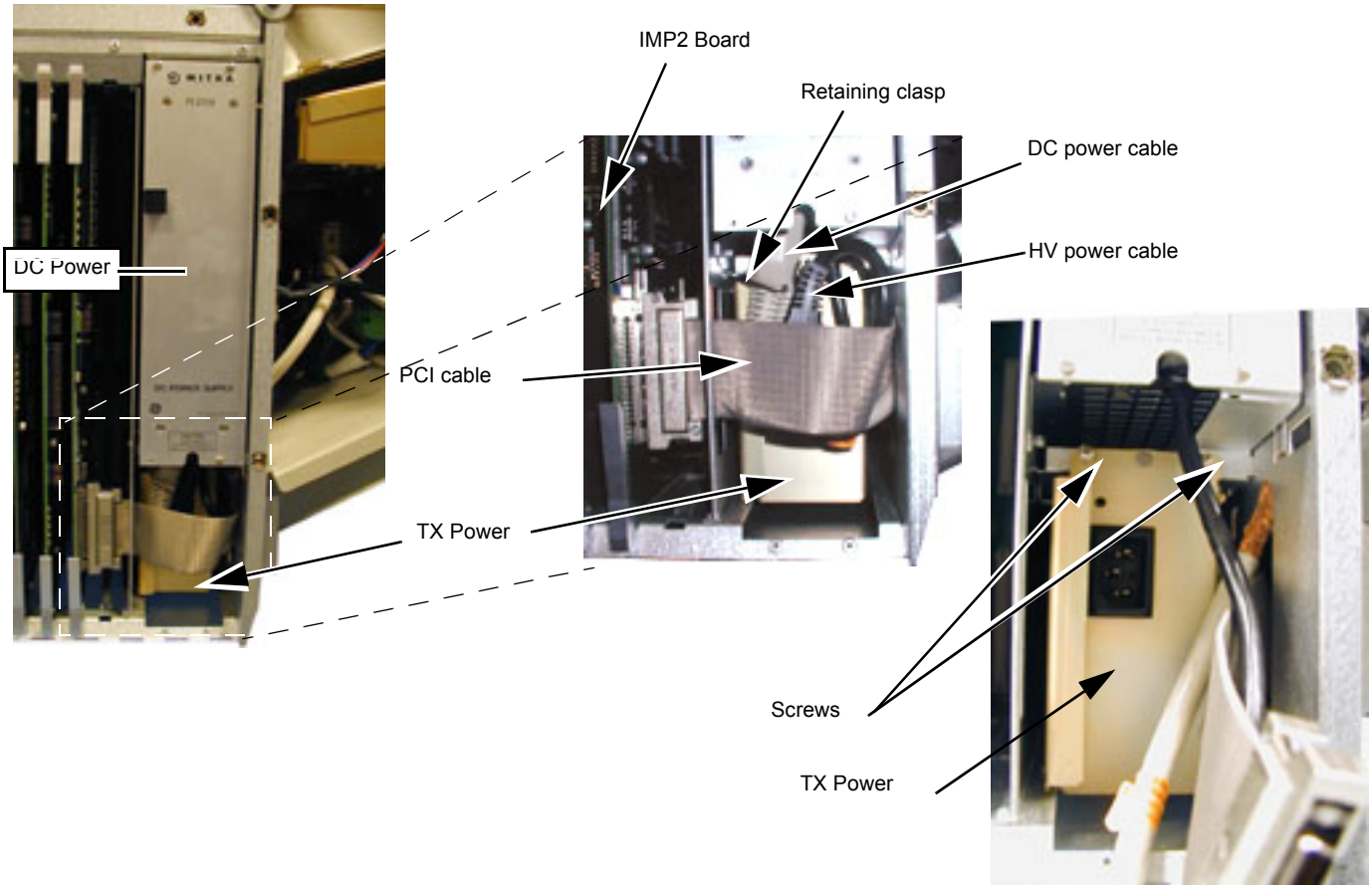


Figure 8-32 DC Power, TX Power and Cabling.

8-4-4-4 TX Power Removal Procedure

1.) Remove retaining clasp from DC Power connector.
2.) Unplug DC Power and TX Power.
3.) Unscrew two (2) screws in front of TX Power.
4.) Push cables aside and pull out TX Power from its socket.

8-4-4-5 TX Power Installation Procedure

1.) Push cables aside and install TX Power.
2.) Fasten two (2) screws.
3.) Connect DC Power and secure the connector with retaining clasp.
4.) Connect TX Power.
5.) Connect PCI cable to IMP2 Board.
6.) Install Right Side Cover as described in "Side Covers Removal Procedure" on page 8-3.
7.) Install Card Rack Cover.

8-4-5 Rear Casters Replacement Procedure

8-4-5-1 Manpower

2 persons, 30 minutes (one Caster)

8-4-5-2 Tools

- Phillips screwdriver size 2
- 5 mm hexagon key
- Bevel Edged Board and Wooden Wedge (both included in package with replacement Casters)

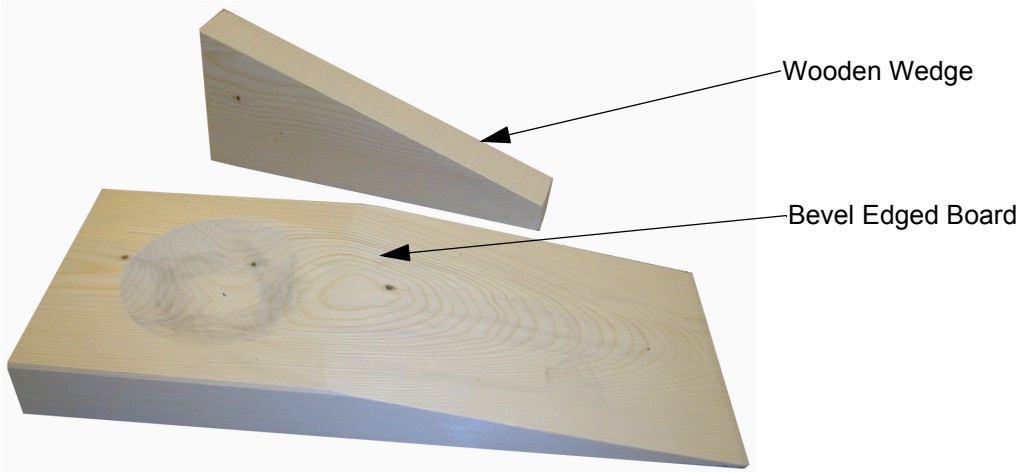


Figure 8-33 Bevel Edged Board and Wooden Wedge.

8-4-5-3 Preparations

1.) Shut down the system as described in "Power Shut Down" on page 4-5.
2.) Remove the Side Covers as described in "Side Covers Removal Procedure" on page 8-3.
3.) Remove Filter Cover As described in "Filter Cover Removal Procedure" on page 8-6.
4.) Remove Lower Rear Cover as described in "Lower Rear Cover Removal Procedure" on page 8-8.

8-4-5-4 Rear Casters Removal Procedure

1.) Turn Front Casters as shown in Figure 8-34.

2.) Activate Direction Lock.

3.) Put the bevel-edged board on the floor.

⚠ **WARNING** ***Prior to elevating scanner, verify that the floating keyboard is locked in its lowest position.***

⚠ **WARNING** ***Use extreme caution as long as VIVID 7 is un-stable, not resting on all four Casters.***

4.) Pull the system backwards up the board incline. This will lift the Rear Wheel on the opposite side of the System from the floor.



Figure 8-34 Pull system backwards up the board incline

8-4-5-4 Rear Casters Removal Procedure (cont'd)

5.) Activate the brakes on all Casters, except the one you intend to replace.

6.) Turn the Rear Caster that stands on the Bevel Edged Board in the direction as shown in Figure 8-35.

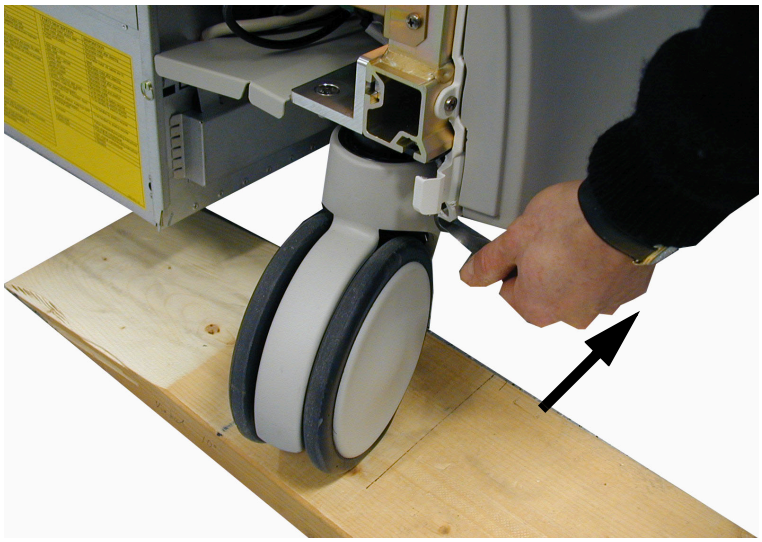


Figure 8-35 Activate Rear Brakes

7.) The system is now nearly balanced between one Front and one Rear Caster (illustrated in this Procedure; Left Front and Right Rear).

8.) Make the System rest on both Front Casters and lift the Rear Caster. Put the Wooden Wedge under the AC Transformer. This will stabilize the System with the Rear Caster free from the floor.

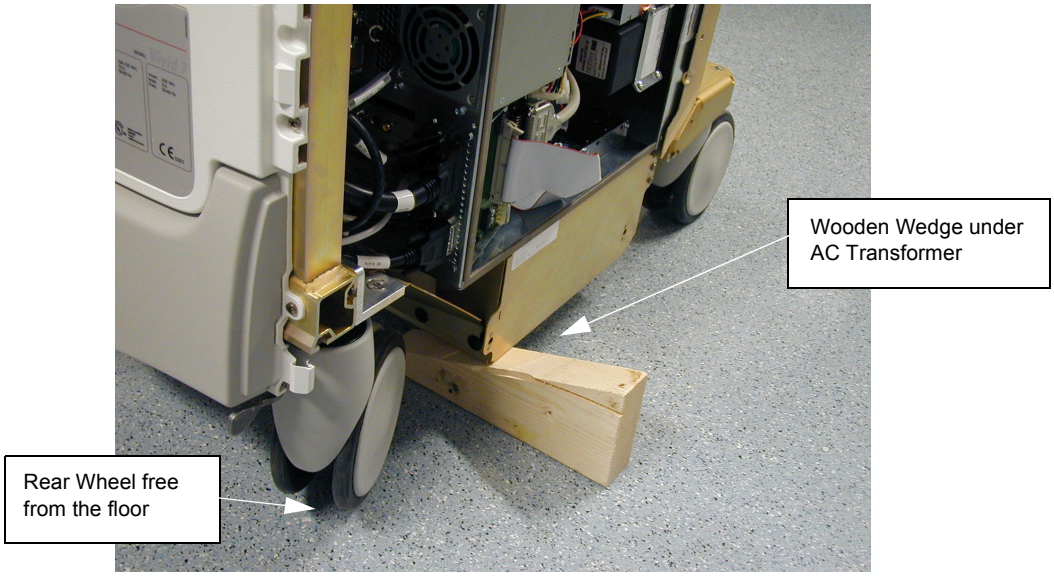


Figure 8-36 System stabilized with Rear Caster free from the floor

8-4-5-4 Rear Casters Removal Procedure (cont'd)

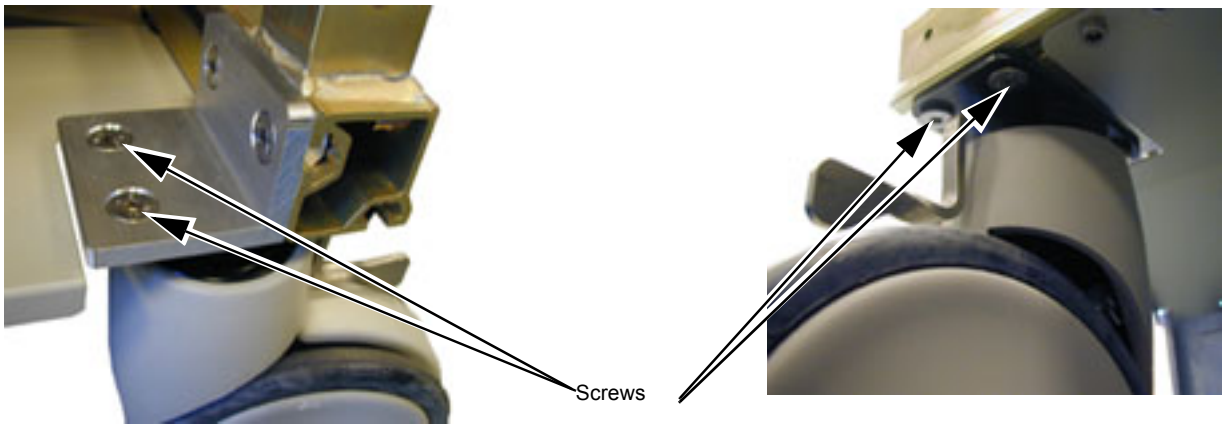


Figure 8-37 Rear Caster fastening

9.) Remove four (4x) screws fastening Caster.

10.) Remove Caster

8-4-5-5 Rear Casters Installation Procedure

1.) Replace the Caster and tightly fasten it with four (4x) screws.

WARNING ***Use extreme caution in the next two steps. The scanner is unstable.***

2.) Remove the Wooden Wedge.
3.) Roll the system off the Bevel Edged Board.
4.) To replace the other Rear Caster, repeat all the steps from "Rear Casters Removal Procedure" on page 8-41, but now using the Bevel Edged board and the Wooden Wedge on the other side of the system.
5.) Install Lower Rear Cover as described in "Lower Rear Cover Installation Procedure" on page 8-8.
6.) Install Filter Cover as described in "Filter Cover Installation Procedure" on page 8-6.
7.) Install Side Covers as described in "Side Covers Installation Procedure" on page 8-4.

8-4-6 Front Casters Replacement Procedure

8-4-6-1 Manpower

1 persons, 30 minutes per Caster

8-4-6-2 Tools

- Torx screwdriver T-20
- Open end wrenches, 10 mm and 134 mm
- 5 mm hexagon key
- Bevel Edged Board and Wooden Wedge (included in package with replacement Casters)

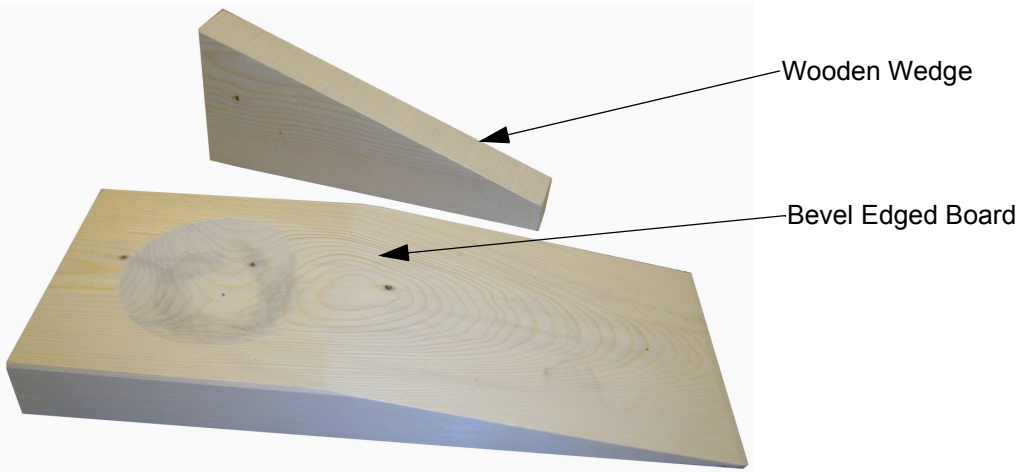


Figure 8-38 Bevel Edged Board and Wooden Wedge.

8-4-6-3 Preparations

1.) Shut down the system as described in "Power Shut Down" on page 4-5.
2.) Remove the Front Bumper as described in "Front Bumper Removal Procedure" on page 8-50.
3.) Turn Front Casters as shown in Figure 8-39.
4.) Activate Direction Lock.
5.) Put the Bevel Edged Board on the floor.

8-4-6-4 Front Casters Removal Procedure

⚠ **WARNING** ***Prior to elevating scanner, verify that the floating keyboard is locked in its lowest position.***

⚠ **WARNING** ***Use extreme caution as long as VIVID 7 is un-stable, not resting on all four Casters.***

6.) Pull the system backwards up the board incline.



Figure 8-39 Pull system backwards up the board incline

7.) Turn the Rear Caster on the board in the direction as shown in Figure 8-40.
8.) Activate both Rear Brakes as shown in Figure 8-40.

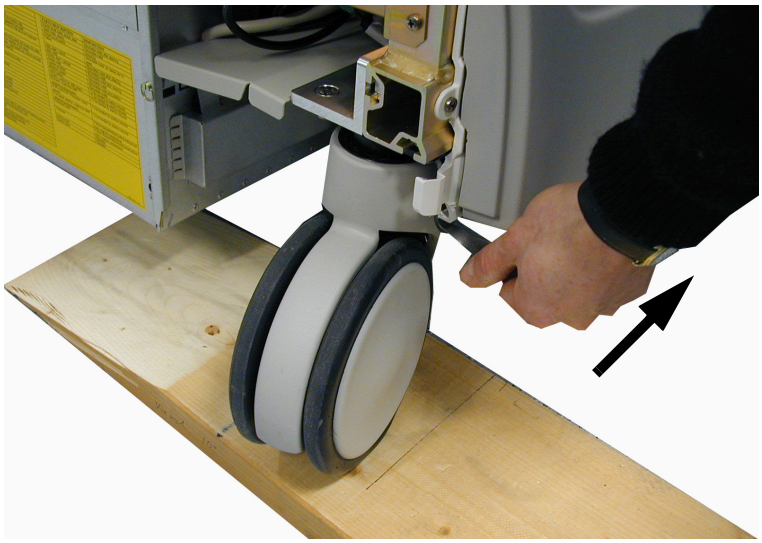


Figure 8-40 Activate both rear brakes

8-4-6-4 Front Casters Removal Procedure (cont'd)

9.) Put the Wooden Wedge under the Card Rack. This will stabilize the System with the right Front Wheel free from the floor.

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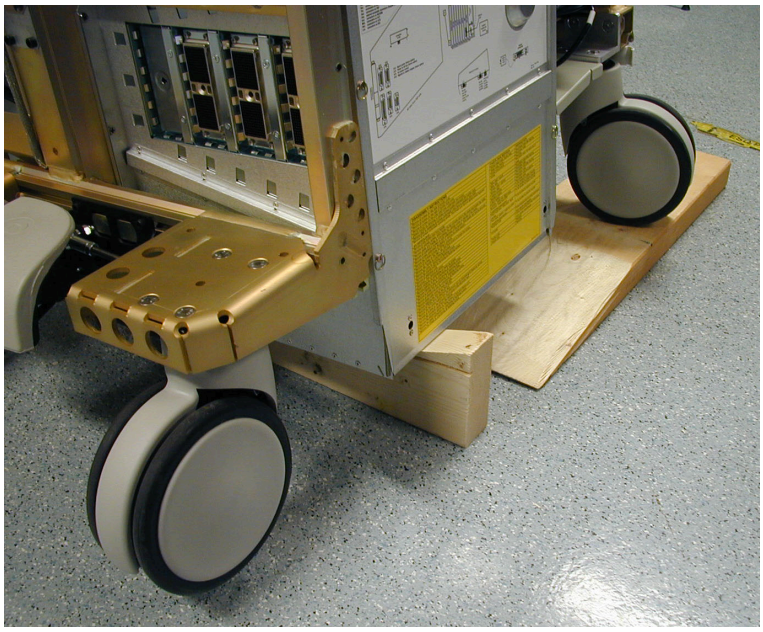


Figure 8-41 System stabilized with front wheel free from the floor

8-4-6-4 Front Casters Removal Procedure (cont'd)

10.)Remove the lock pin that secures the balljoint.

11.)Pull balljoint apart.

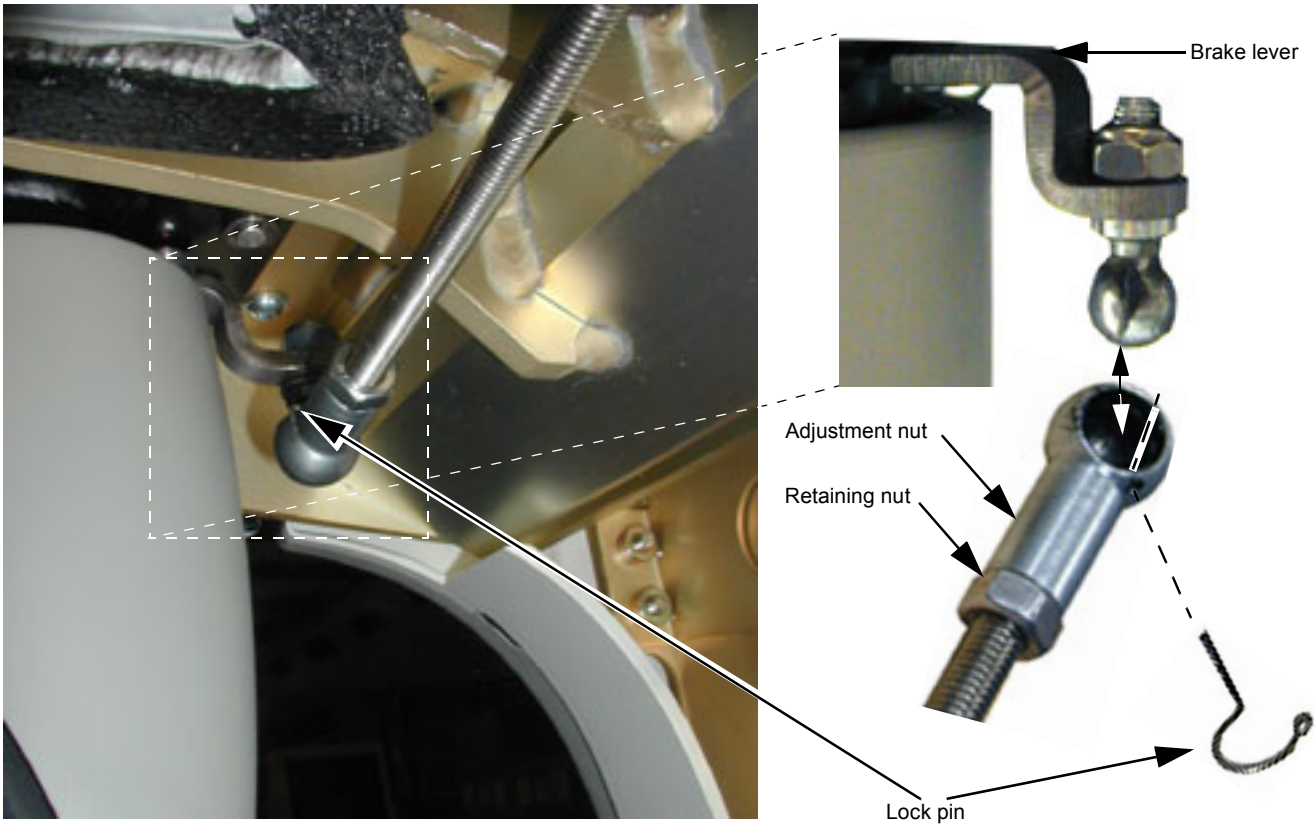


Figure 8-42 Front Caster Brake Arm and Ball Joint Parts



Figure 8-43 Caster fastening (both Casters shown)

12.)Unscrew four (4x) screws.

13.)Remove the Caster.

8-4-6-5 Front Casters Installation Procedure

1.) Move the ball piece of the joint from old Caster to new Caster (See Figure 8-42).
2.) Align new Caster on the frame and fasten it tightly with four (4x) hexagon screws.
3.) Press the balljoint together and install the lock pin (See Figure 8-42).
4.) To replace the other Front Caster, repeat all the steps from "Front Casters Removal Procedure" on page 8-46, but now using the Bevel Edged board and the Wooden Wedge on the other side of the system.
5.) Install Bumper and Covers as described in "Front Bumper Installation Procedure" on page 8-50.
6.) Roll the system off the Bevel Edged Board.

8-4-7 Front Bumper Replacement Procedure

8-4-7-1 Manpower

One person, 30 minutes

8-4-7-2 Tools

- Phillips size 2
- Torx screwdriver T-20

8-4-7-3 Preparations

1.) Shut down the system as described in "Power Shut Down" on page 4-5.

2.) Remove Front Cover as described in "Front Cover Removal Procedure" on page 8-5.

8-4-7-4 Front Bumper Removal Procedure

1.) Unscrew 4 Torx screws under the bumper.

2.) Lift the bumper off.

8-4-7-5 Front Bumper Installation Procedure

1.) Put the new bumper in position.

2.) Fasten the 4 screws.

NOTE: Gentle. Don't use power.

3.) Install Front Cover as described in "Front Cover Installation Procedure" on page 8-5.



Figure 8-44 System front and Front Bumper

8-4-8 Brake Pedal Replacement Procedure

8-4-8-1 Manpower

One person, 15 minutes

8-4-8-2 Tools

Torx screwdriver T-20

8-4-8-3 Brake Pedal Replacement Procedure

1.) Unscrew 4 screws under the pedal.
2.) Replace the pedal with a new one.
3.) Fasten 4 screws.



Figure 8-45 Brake Pedal

8-4-9 Direction Lock Pedal Replacement Procedure

8-4-9-1 Manpower

One person, 15 minutes

8-4-9-2 Tools

Torx screwdriver T-20

8-4-9-3 Direction Lock Replacement Procedure

1.) Unscrew 4 screws, 3 under and 1 at the left side of the pedal.
2.) Replace the pedal with a new one.
3.) Fasten 4 screws.

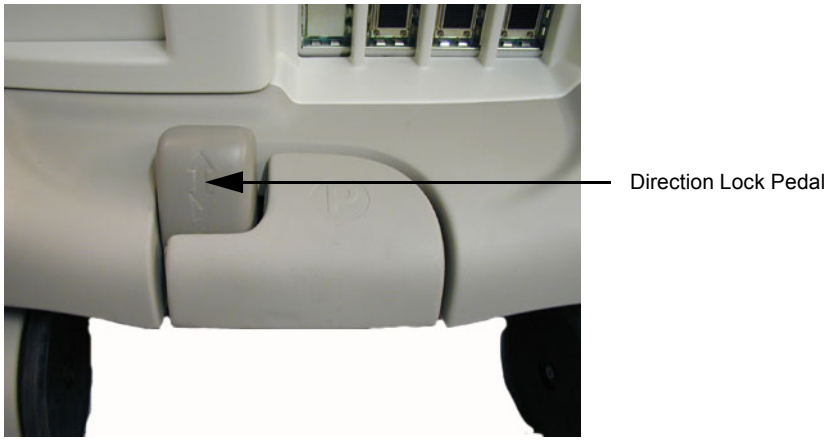


Figure 8-46 Direction Lock Pedal

8-4-10 Brake Pedal and Direction Lock Assembly Replacement Procedures

8-4-10-1 Manpower

One person, 1 hour

8-4-10-2 Tools

- Phillips screwdriver size 2
- Hexagon key 5 mm
- Torx screwdriver T-20
- Wrench 11 and 13 mm

8-4-10-3 Preparations

1.) Remove Front Bumper as described in "Front Bumper Removal Procedure" on page 8-50.
2.) Remove footrests on both pedals by unscrewing 4 Torx screws on each.

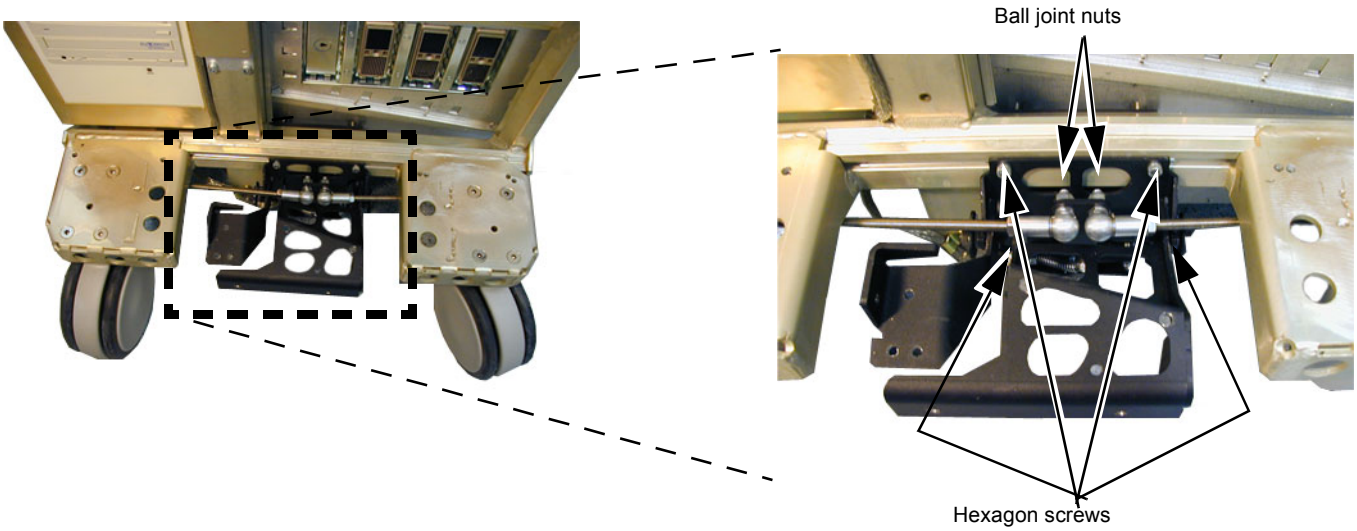


Figure 8-47 Brake Assembly

8-4-10-4 Brake pedal and Direction Lock Removal Procedure

1.) Unscrew 2 nuts on the two ball joints on the brake rods, located over the middle of brake assembly. Wrench 11 and 13.
2.) Unscrew the 4 hexagon screws. Two of them located under the Brake Assembly.

NOTE: The nuts may slide out of position.

3.) Remove the Brake Pedal and Direction Lock Assembly.

8-4-10-5 Brake pedal and Direction Lock Installation procedure

1.) Put the Brake Pedal and Direction Lock Assembly in position and fasten the 4 hexagon screws loosely in the sliding nuts.
2.) Fasten the ball joint nuts before tightening the 4 hexagon screws.
3.) Install Front Bumper as described in "Front Bumper Installation Procedure" on page 8-50.
4.) Fasten footrests to Brake Pedal and Direction Lock Assembly. Fasten the screws gently.

8-4-11 Power Supply Battery Pack Replacement Procedure

8-4-11-1 Tools

Phillips screwdriver 2

8-4-11-2 Manpower

One person, 1 hour

8-4-11-3 Preparations

1.) Shut down the system as described in "Power Shut Down" on page 4-5.
2.) Remove Left Side Cover as described in "Side Covers Removal Procedure" on page 8-3.

8-4-11-4 Power Supply Battery Pack Removal Procedure

1.) Remove Backend Processor Cover.
2.) Remove the four screws from Power Supply Battery Pack cover plate.
3.) Disconnect Battery Pack connection wire.
4.) Remove Power Supply Battery Pack from Backend Processor.

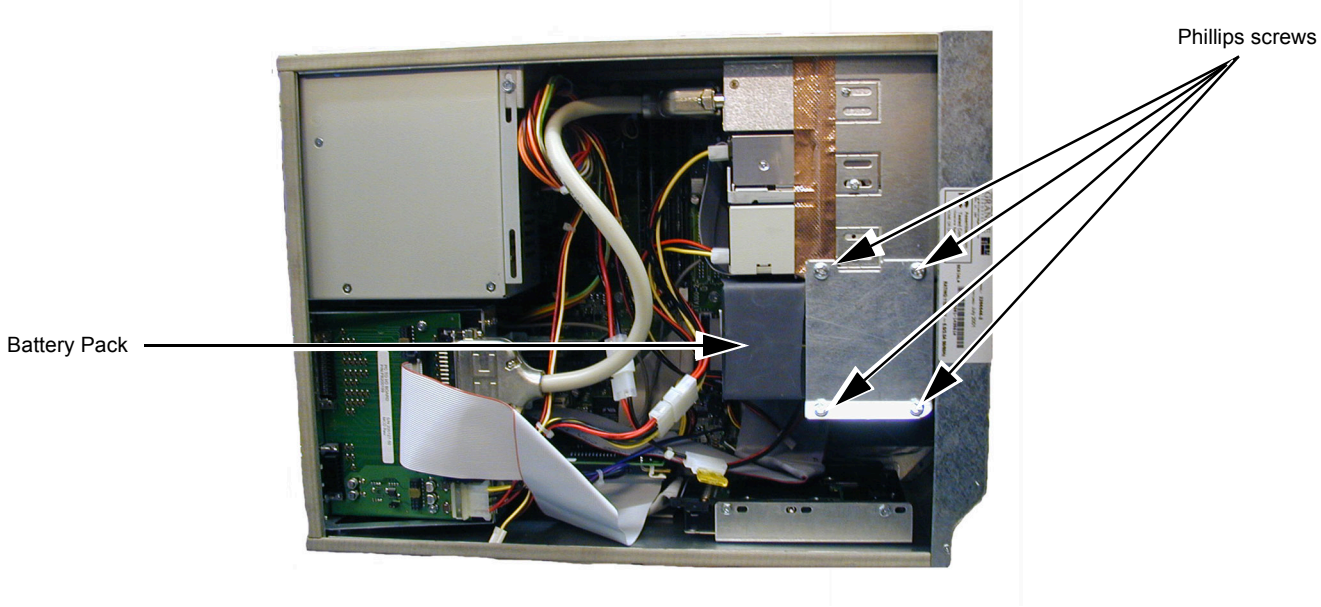


Figure 8-48 Power Supply Battery Pack

8-4-11-5 Power Supply Battery Pack Installation Procedure

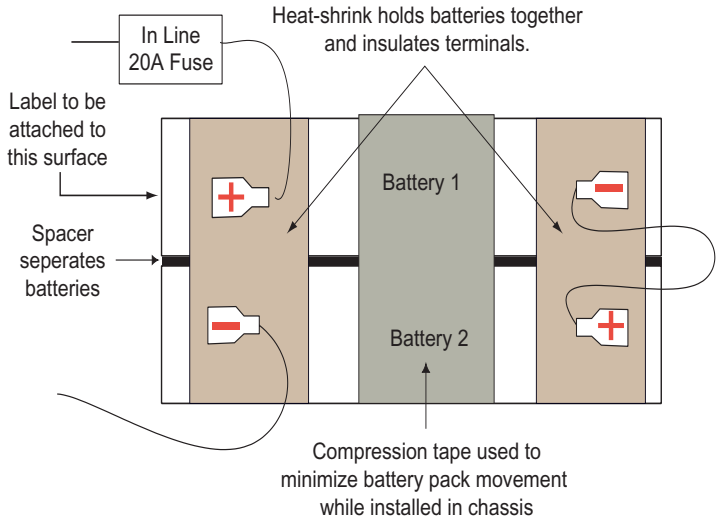


Figure 8-49 Battery Pack Block Diagram

1.) Slide the new Power Supply Battery Pack into its position in Backend Processor.
2.) Connect Battery Pack to power supply connector.

CAUTION **The battery pack contains a 24V charge that will cause a spark when it is re-connected to the power supply. Be careful that this spark does not damage any equipment or cause any personal injury.**

3.) Attach Power Supply Battery Pack cover plate and secure it with the four screws.
4.) Install Backend Processor Cover.
5.) Install Side Cover "Side Covers Installation Procedure" on page 8-4
6.) Boot-up the system.
7.) Do a functional check-out by turning off power by the mains circuit breaker at the AC Power module at the rear of the System.
- The Battery Pack provides BEP with power to a proper shut down, which takes some seconds.

The UPS batteries will drain slightly when the system is in the *Off Condition*.

The *Off Condition* is defined as:

- Circuit Breaker in the OFF position
- System unplugged from the wall outlet

If the system is left in the OFF condition for an extended period of time (3 to 5 days or more), the system may not boot up or may beep when turned ON. Should this occur, the system needs to recharge the UPS batteries. This could take 15 minutes to as long as 24 hours, depending on the battery age, system input voltage and system temperature.

To eliminate draining the UPS batteries, the system should remain plugged into the wall outlet with the circuit breaker in the ON position.

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Chapter 9
Renewal Parts

Section 9-1
Overview

9-1-1 Purpose of Chapter 9

This chapter gives you an overview of Spare Parts for Vivid 7 / Vivid 7 PRO.

Table 9-1 Contents in Chapter 9

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9-1-1-1 Equipment Models Covered in this Chapter

Table 9-2 Vivid 7 / Vivid 7 PRO Models Covered in this Manual

GE VINGMED PART NUMBER	DESCRIPTION	VOLTAGE
FB000030	VIVID 7 (BT'01)	230 VAC
FC000060	VIVID 7 (BT'01)	100 - 120 VAC
FC000180	VIVID 7 PRO (BT'02)	220 - 240 VAC
FC000190	VIVID 7 PRO (BT'02)	100 - 120 VAC
FC000200	VIVID 7 (BT'02)	220 - 240 VAC
FC000210	VIVID 7 (BT'02)	100 - 120 VAC

Section 9-2
List of Abbreviations

Table 9-3 List of Abbreviations

ABBREVIATIONS	DESCRIPTION
Assy	Assembly
BEP	Back End Processor
Ctrl	Control
FEP	Front End Processor
F.O.B.	Flock of Birds or 3-D Option (Not available on this scanner)
FRU 1	Replacement part available in parts hub
FRU 2	Replacement part available from the manufacturer (lead time involved)
FRU N	Non stock part
LCD	Liquid Crystal Display
Int	Internal
I/O	Input/Output
PC	Personal Computer (Back End Processor)
PS	Power Supply
PWA	Printed Wire Assembly
QTY	Quantity used per scanner
XFRMR	Transformer

Section 9-3
Parts List Groups

Table 9-4 Parts List Groups

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Section 9-4
Plastic Parts, Console, Top and Front

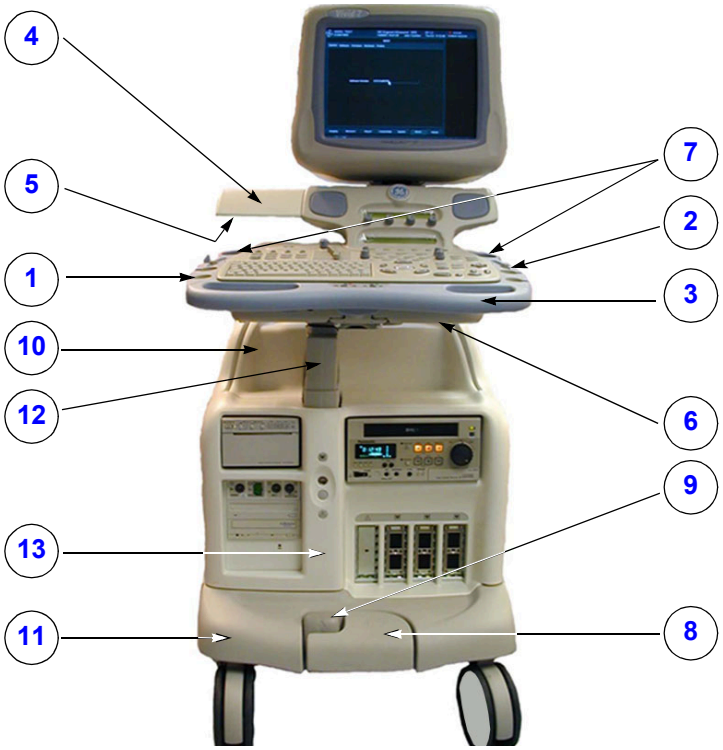


Figure 9-1 Plastic Parts, Front View of Vivid 7 / Vivid 7 PRO

Table 9-5 Plastic Parts, Console, Top and Front

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	PROBEHOLDER, LEFT	FB307293	Probe Holder, Left	1	1
2	PROBEHOLDER, RIGHT	FB307294	Probe Holder, Right	1	1
3	HANDLE, MAIN	FC200131	Common Front Handle with Label.	1	1
4	SHELF	FB307307		1	1
5	COVER, UNDERSHELF	FB307308		1	2
6	COVER, UNDER	FB307405	Below Control Panel	1	2
7	CUP, GEL	FB307313		2	2
8	PEDAL, LOCK	FB307407	Pedal lock pad.	1	1
9	PEDAL, DIRECTIONLOCK	FB307409	Pedal direction lock pad.	1	1
10	COVER, TOP	FB307383		1	1
11	BUMPER FOOTREST	FB307387		1	1

Table 9-5 Plastic Parts, Console, Top and Front (continued)

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
12	COLUMN COVERS KIT	FC200183	(Same as FC200088)	1	1
13	COVER, FRONT	FC200076		1	2

Section 9-5
Plastic Parts, Airduct Cover and Cover Boxes

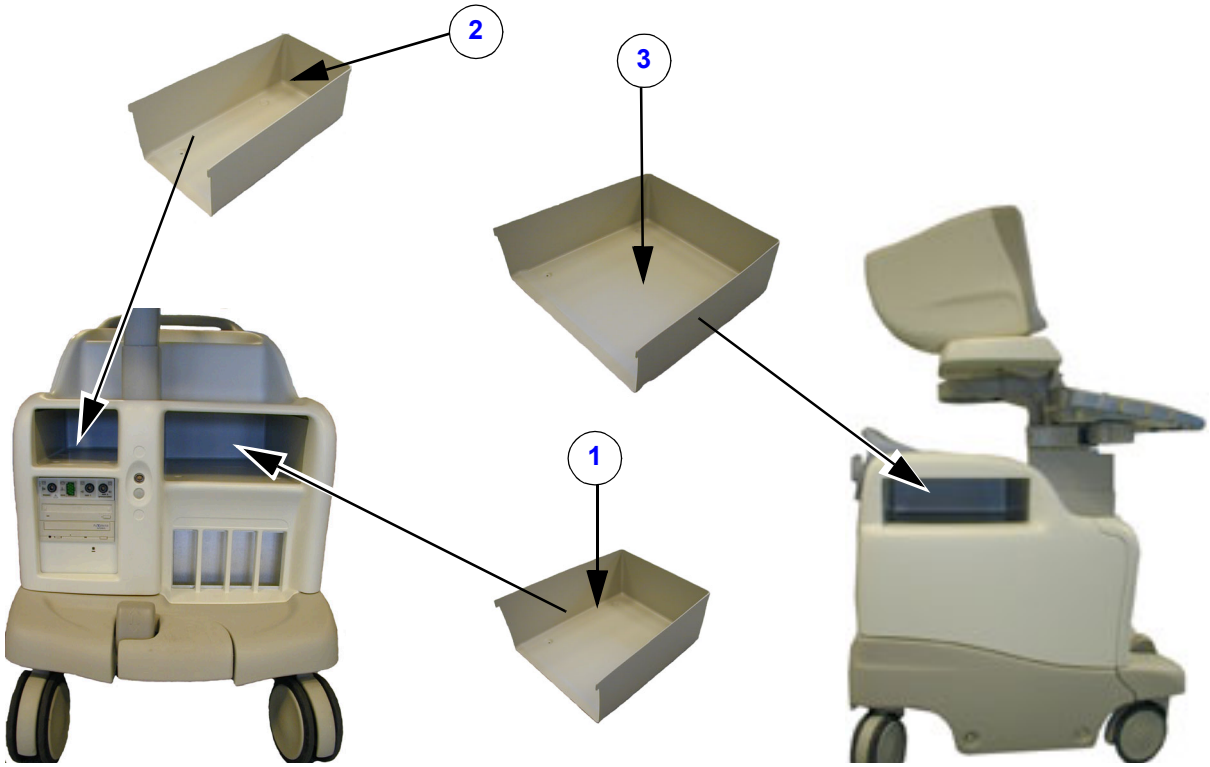


Figure 9-2 Plastic parts, Airduct Cover and Cover boxes

Table 9-6 Plastic Parts, Airduct Cover and Cover Boxes

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	COVER BOX, VCR	FB307988		1	1
2	COVER BOX B/W-PRINTER	FB307989		1	1
3	COVER BOX COLOR PRINTER	FB307990		1	1

Section 9-6
Plastic Parts, Covers and Bumpers, Left, Right and Rear

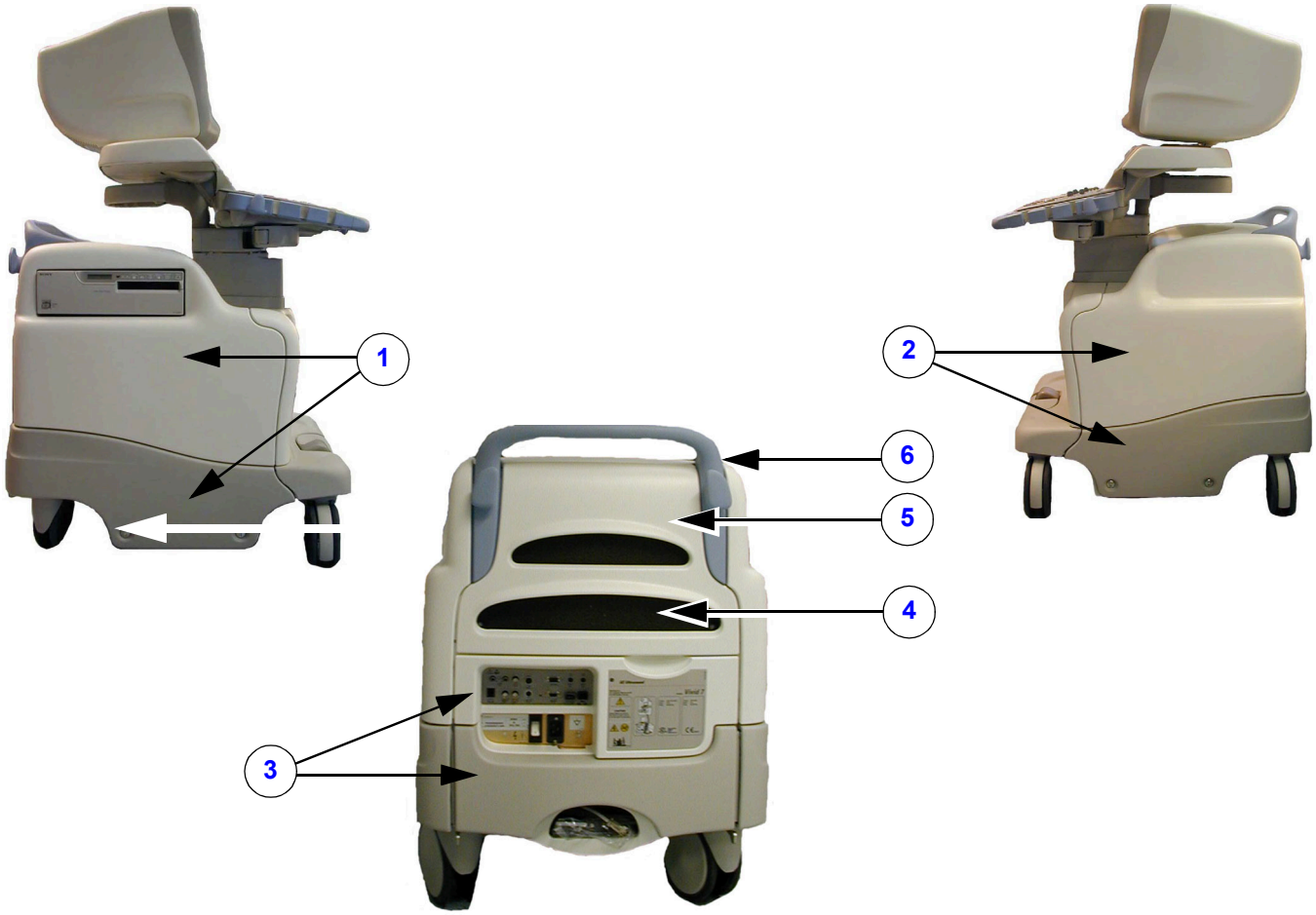


Figure 9-3 Plastic Parts, Covers and Bumpers, Left, Right and Rear.

Table 9-7 Plastic Parts, Covers and Bumpers, Left, Right and Rear

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	COVER LEFT SIDE WITH BUMPER	FC200073		1	1
2	COVER RIGHT SIDE WITH BUMPER	FC200074		1	1
3	COVER REAR WITH BUMPER	FC200077		1	1
4	COVER, FILTER	FB200385		1	1
5	FILTER BLOCK (DUST FILTER)	FB307903		1	1
6	HANDLE, REAR W/ CABLE HOOKS	FB307406		1	1

Section 9-7
Control Panel Parts

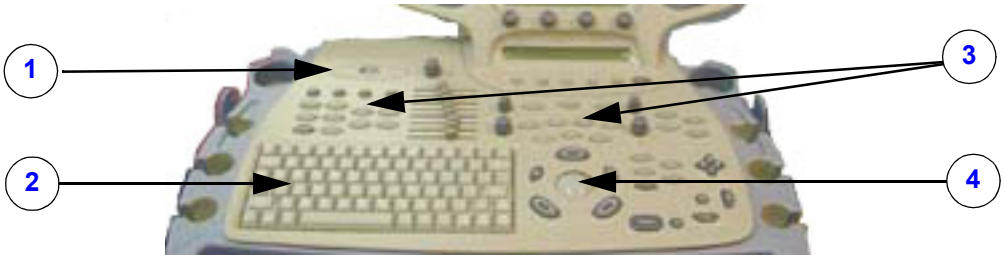


Figure 9-4 Operator Panel Parts

Table 9-8 Operator Panel Parts

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	OPERATOR PANEL - ENGLISH	FA200920		1	1
2	QUERTY KEYBOARD [language]	See Below		-	-
	QUERTY KEYBOARD UNIVERSAL	066E1101	English	1	1
	QUERTY KEYBOARD FRENCH	066E1102		1	1
	QUERTY KEYBOARD SWEDISH	066E1107		1	1
	QUERTY KEYBOARD NORWEGIAN	066E1108		1	1
	QUERTY KEYBOARD RUSSIAN	066E1111		1	1
	QUERTY KEYBOARD GREEK	066E1112		1	1
3	KEYPADS [language] FOR OP-PANEL	See Below		-	-
	KEYPADS ENGLISH FOR OP-PANEL	066E1201		1	2
	KEYPADS FRENCH FOR OP-PANEL	066E1202		1	2
	KEYPADS GERMAN FOR OP-PANEL	066E1203		1	2
	KEYPADS SPANISH FOR OP-PANEL	066E1204		1	2
	KEYPADS PORTUG. FOR OP-PANEL	066E1205		1	2
	KEYPADS ITALIAN FOR OP-PANEL	066E1206		1	2
	KEYPADS SWEDISH FOR OP-PANEL	066E1207		1	2
	KEYPADS NORWEG. FOR OP-PANEL	066E1208		1	2
	KEYPADS DANISH FOR OP-PANEL	066E1209		1	2
	KEYPADS DUTCH FOR OP-PANEL	066E1210		1	2
	KEYPADS RUSSIAN FOR OP-PANEL	066E1211		1	2
	KEYPADS GREEK FOR OP-PANEL	066E1212		1	2
	KEYPADS TURKISH FOR OP-PANEL	066E1213		1	2
4	Trackball	2188902-5		1	1

Section 9-8
Monitor

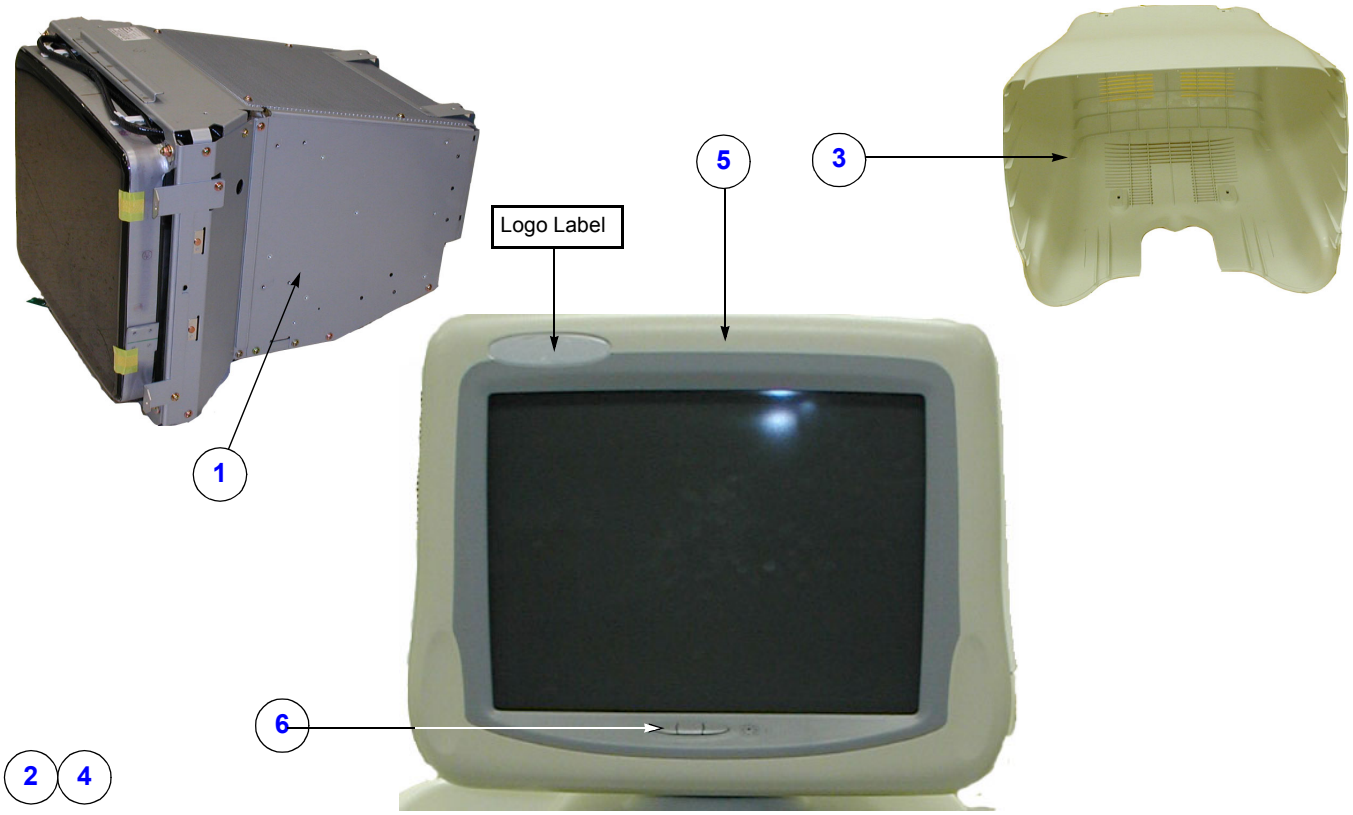


Figure 9-5 Monitor Assembly

Table 9-9 Monitor Parts

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	OPEN FRAME MONITOR 17"	2283334		1	1
2	MONITOR CABLE KIT	2304171		1	1
3	MONITOR REAR COVER ASSEMBLY	2303930	(Without speakers)	1	2
4	MONITOR SCREW CAPS	2303932	(	2	2
5	MONITOR FRONT BEZEL ASSEMBLY	2303929	This assembly contains different logo labels. - Please choose the appropriate one and attach it to the Monitor Front Bezel. - Discard the other labels. (	1	2
6	MONITOR SWITCH ASSEMBLY	2297050		1	2

Section 9-9
Input /Output Modules

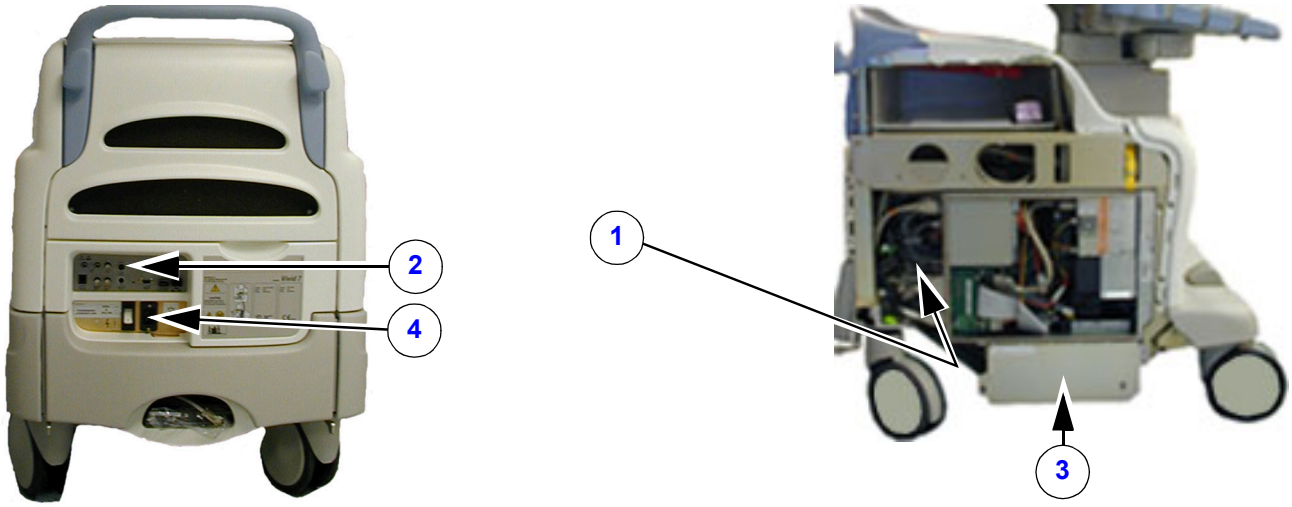


Figure 9-6 I/0's, Transformer Box, AC Power and AC Controller

Table 9-10 I/0's, Transformer Box, AC Power and AC Controller

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	INTERNAL I/O BOARD COMPLETE	FB200197		1	1
2	EXTERNAL I/O BOARD COMPLETE	FB200198		1	1
3	TRANSFORMER BOX COMPLETE	FB200581		1	2
4	AC POWER [voltage]	See below	See below	1	1
	AC POWER 100-120V	FC200079	For Field Service use. Replaces FB200724 on 100-120 VAC Systems.		
	AC POWER 220-240V	FC200081	For Field Service use. Replaces FB200724 on 220-240 VAC Systems.		

Section 9-10
PCB Boards

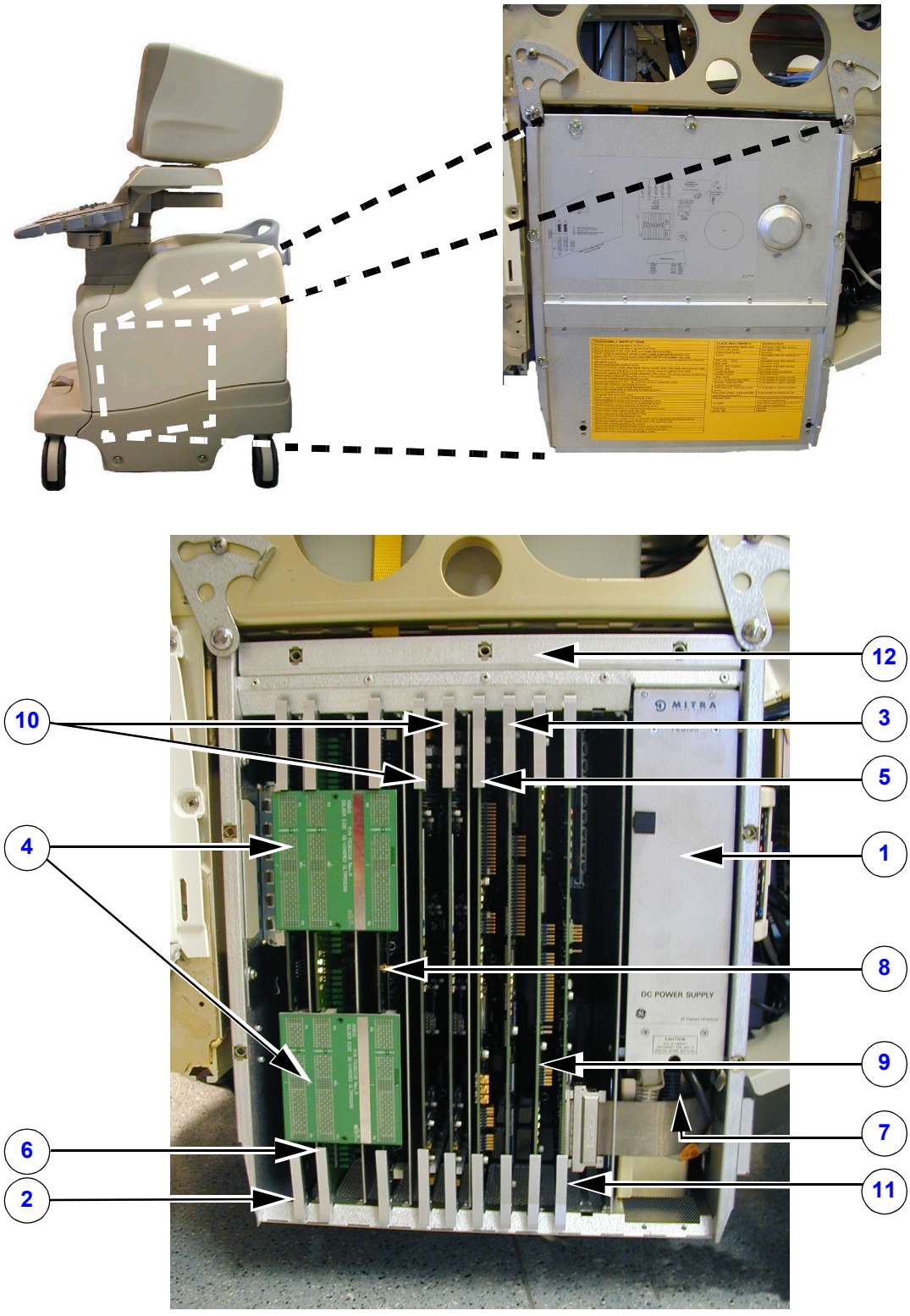


Figure 9-7 PCB Boards

Section 9-10 PCB Boards (cont'd)

Table 9-11 PCB Boards

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	POWER SUPPLY DC	FA200945	DC Power Supply	1	1
2	RLY-3	FB200060	Relay PCB, version 3	1	1
3	PCB RF TISSUE	FB200140	Radio Frequency & Tissue PCB	1	1
4	PCB XDBUS-2	FB200158	Transducer Bus PCB, version 2	2	1
5	PCB FEC-II	FB200165	Front End Controller PCB, version 2	1	1
6	PCB TX-128-2	FB200170	Transmitter 128 PCB, version 2	1	1
	PCB TX-128-3	FC200022	Transmitter 128 PCB, version 3		
7	Power, TX	FB200574	Transmitter PS Switched Mode	1	1
8	PCB RX-128-3B	FB200831	Receiver PCB, version 3B	1	1
9	PCB SDP	FB200865	Spectrum Doppler Processor PCB	1	1
10	PCB BF64	FB200900	Beam Former PCB	2	1
11	PCB IMP-2B	FB200991	Image Port PCB, version 2B	1	1
12	RACK W/ MOTHERBOARD	FB200957		1	1

Section 9-11
Mechanical Parts, Rack, Casters and Frogleg

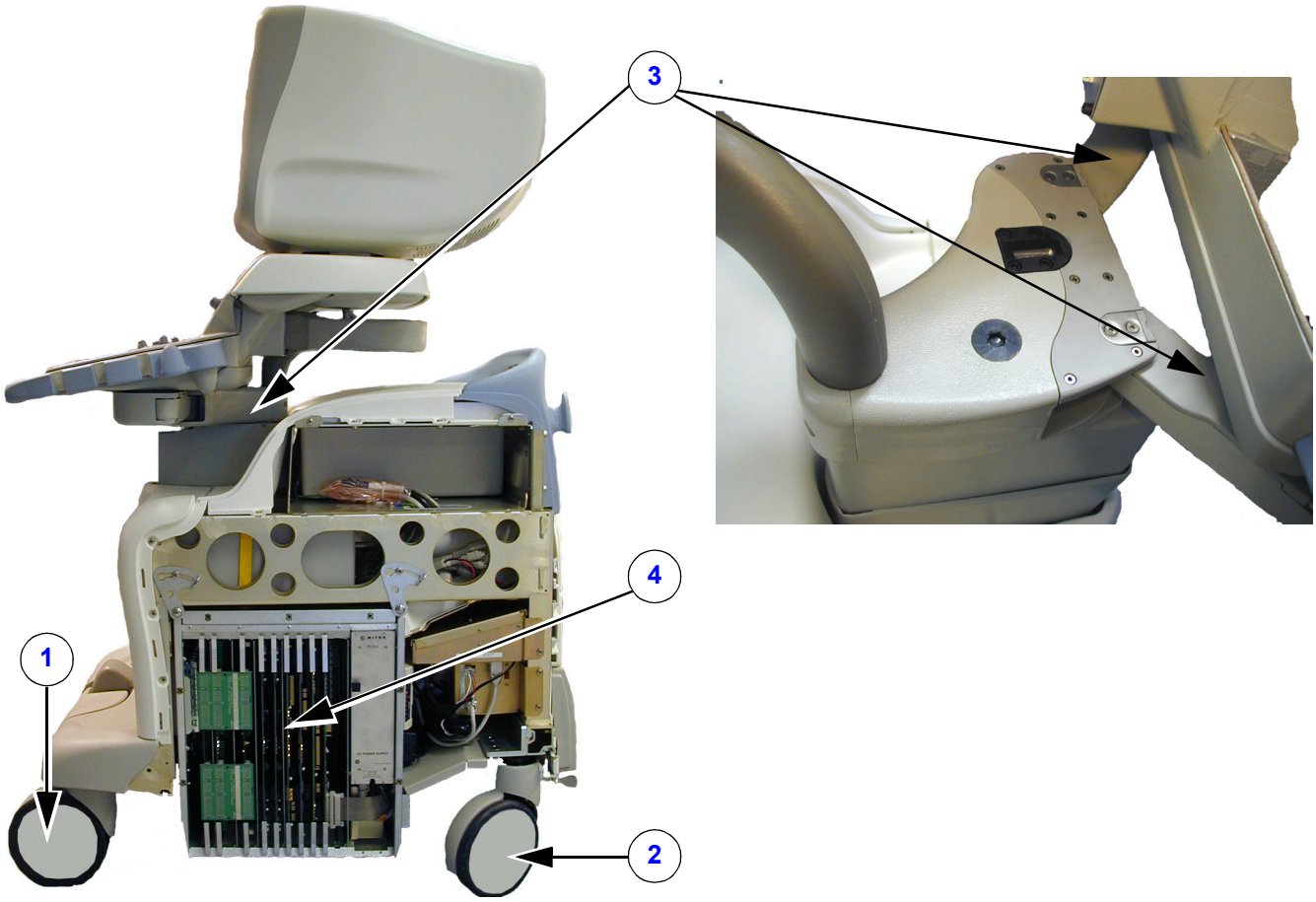


Figure 9-8 Mechanical Parts, Rack, Casters and Frogleg

Table 9-12 Mechanical Parts, Rack, Casters and Frogleg

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	CASTER FRONT	2293008-2	Front Caster without Swivel Lock Assembly.	2	1
2	CASTER REAR	2293008-3	Rear Caster with Swivel Lock Assembly.	2	1
3	FROGLEG, COMPLETE (Vivid 7)	FB200340		1	N
	CASTING COMPLETE (VIVID 7 PRO)	FC200186	Casting Complete	1	2
4	RACK W/ MOTHERBOARD	FB200957		1	1

Section 9-12
Brake Assembly and Console Lock

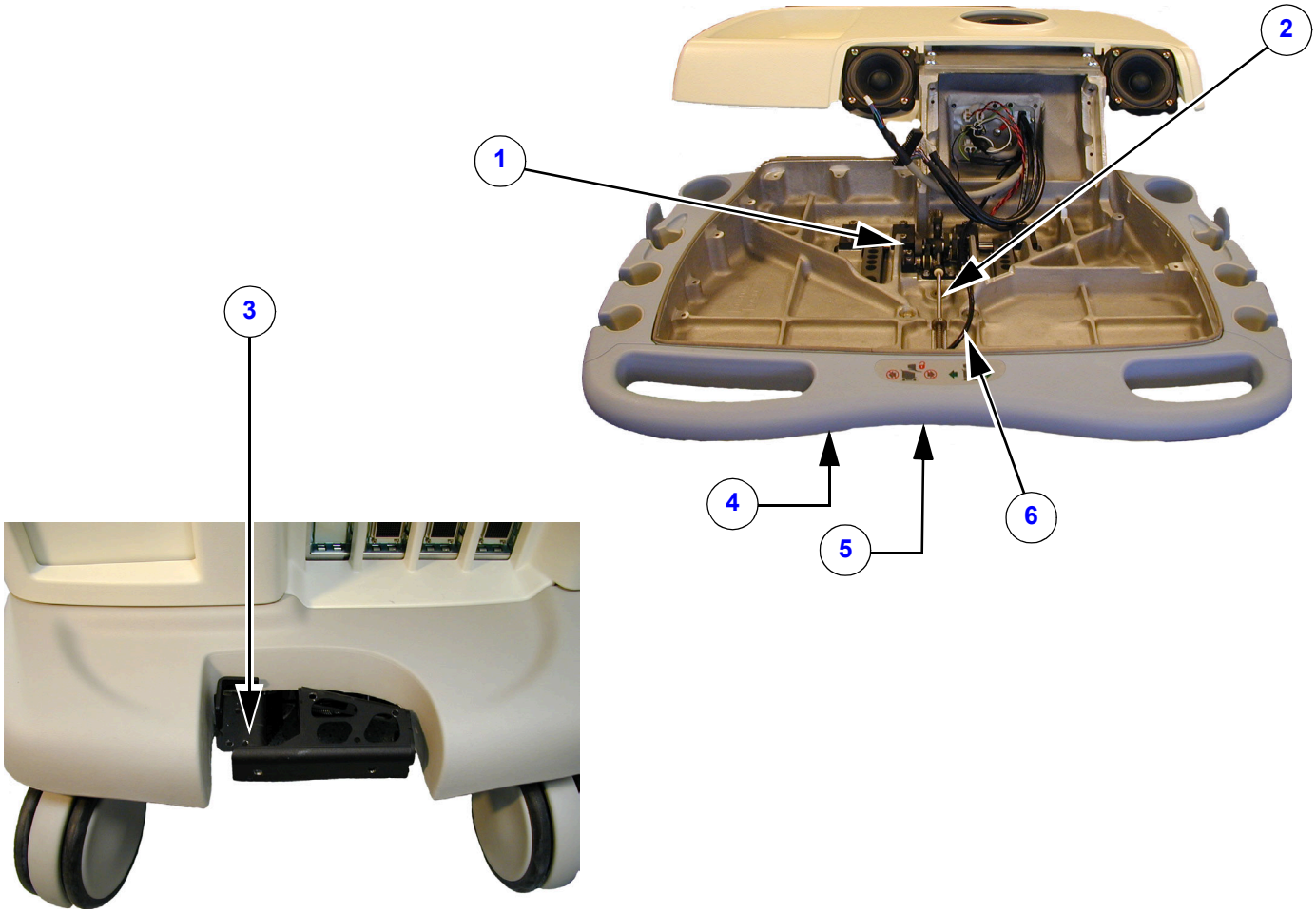


Figure 9-9 Mechanical Parts, Brake Assembly and Console Lock

Table 9-13 Mechanical Parts, Brake Assembly and Console Lock

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	COMMON TOP CONSOLE LOCK ASSY	FB200350		1	2
2	RELEASE LOCK	FB200920		1	2
3	PEDAL ASSEMBLY	FB200595	Brake Pedal Assembly	1	1
4	HANDLE, Z-RELEASE	FB307296		1	2
5	HANDLE, XY-RELEASE	FB307297		1	2
6	WIRECABLE	FB307375	Wire used when operating vertical movement of Top Console	1	2

Section 9-13
Cables

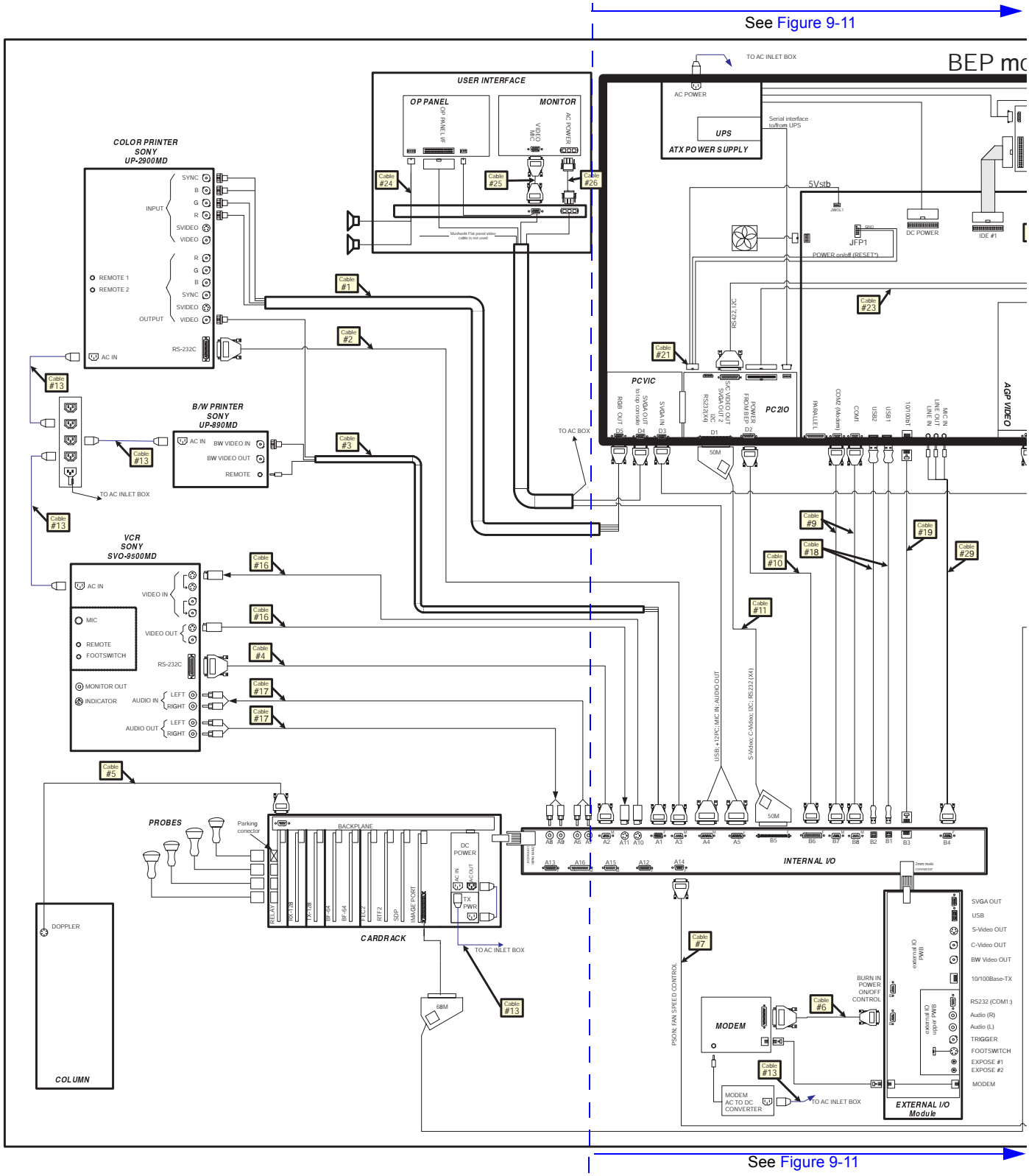
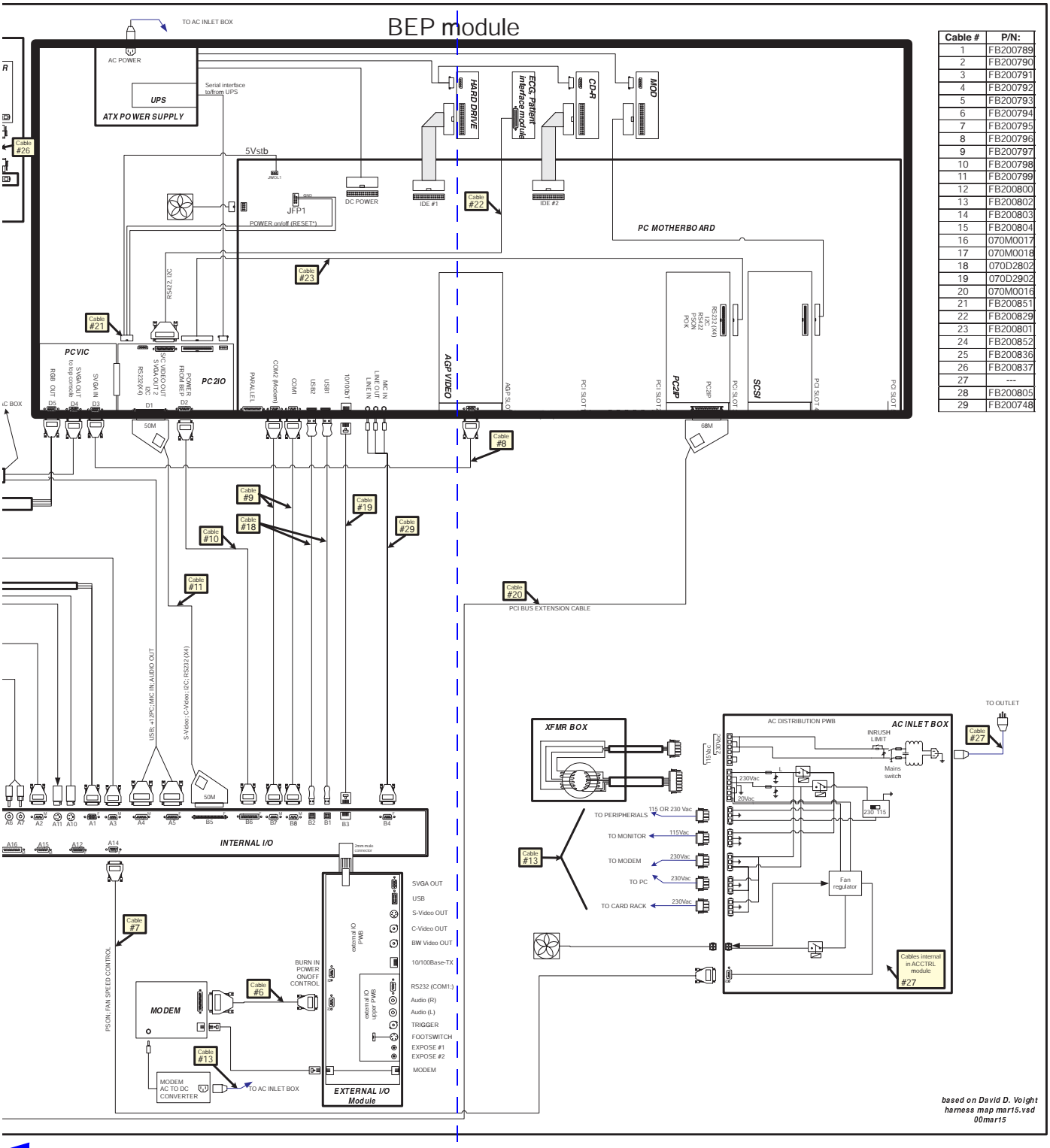


Figure 9-10 Vivid 7 / Vivid 7 PRO Interconnect Cabling, (Left Part of Drawing)

Section 9-13 Cables (cont'd)

See Figure 9-10



Cable #	P/N:
1	FB200789
2	FB200790
3	FB200791
4	FB200792
5	FB200793
6	FB200794
7	FB200795
8	FB200796
9	FB200797
10	FB200798
11	FB200799
12	FB200800
13	FB200802
14	FB200803
15	FB200804
16	070M0017
17	070M0018
18	070D2802
19	070D2902
20	070M0016
21	FB200851
22	FB200829
23	FB200801
24	FB200852
25	FB200836
26	FB200837
27	---
28	FB200805
29	FB200748

See Figure 9-10

Figure 9-11 Vivid 7 / Vivid 7 PRO Interconnect Cabling (Right Part of Drawing)

Section 9-13 Cables (cont'd)

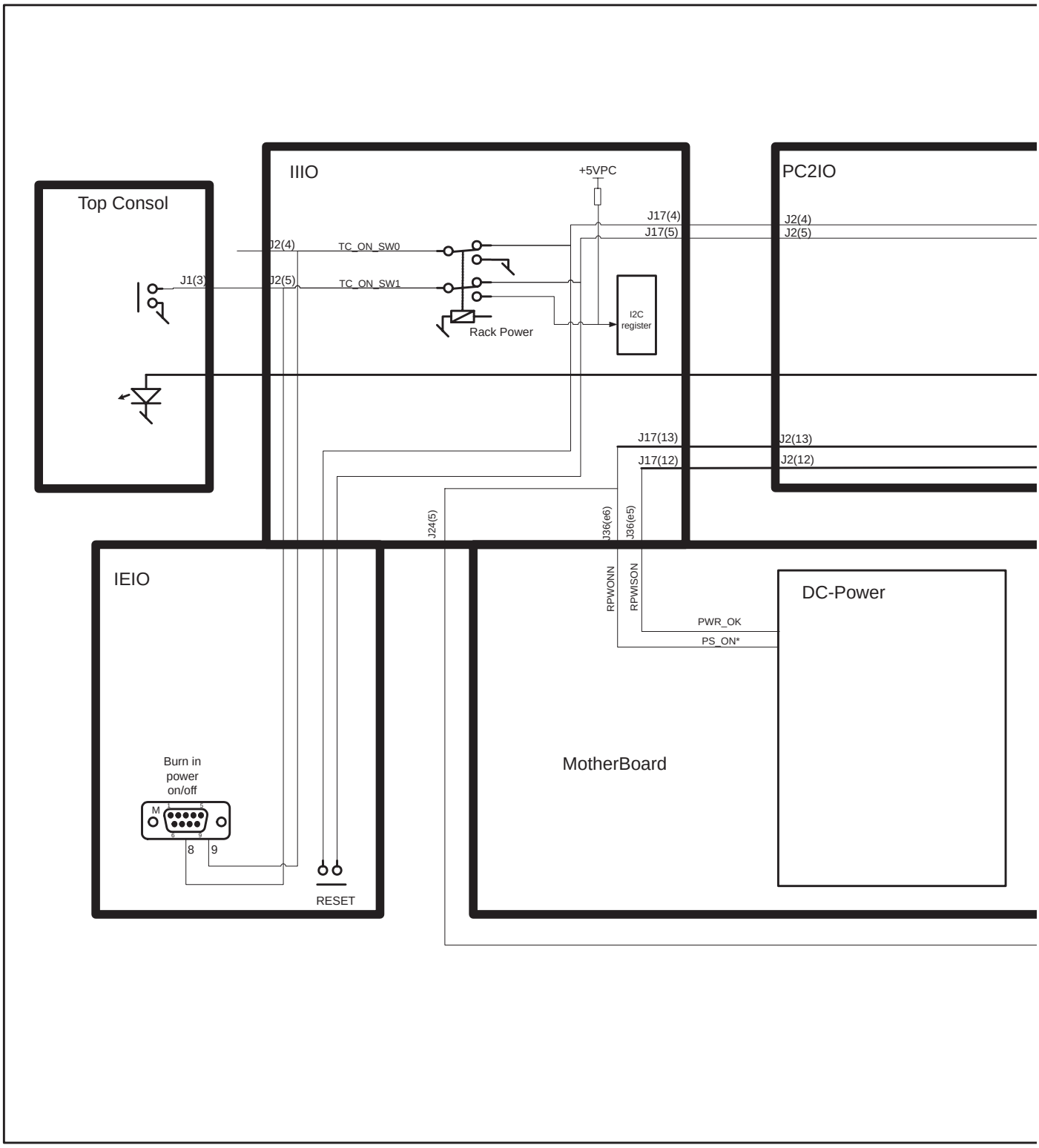


Figure 9-12 Scanner Power Wiring, Left Part of Drawing

Section 9-13 Cables (cont'd)

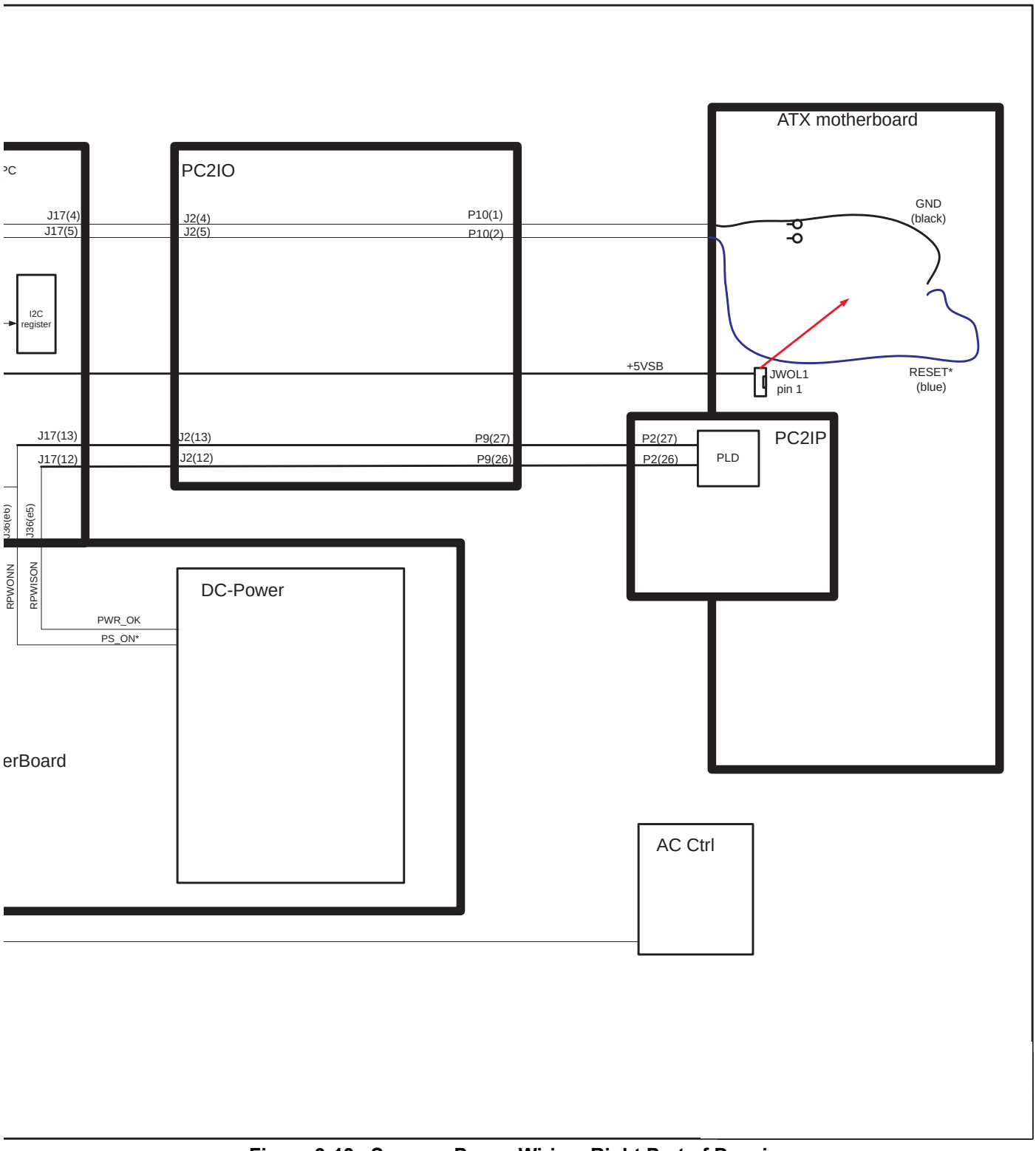


Figure 9-13 Scanner Power Wiring, Right Part of Drawing

Section 9-13 Cables (cont'd)

Table 9-14 Power Cables

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	CABLE POWER 220V AC PLUG EU	070C3194		1	1
2	CABLE POWER 110 V AC, PLUG US	070C3193		1	1
3	CABLES, AC-POWER	FB200802		1	1
4	CABLE, AC MAINS 1	FB200803	ACT-M1 to ACP-F6 	1	1
5	CABLE, AC MAINS 2	FB200804	ACT-M2 to ACP-F7 	1	1

Table 9-15 ECG Cables

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	CABLE ECG MARQ. AHA/AMERICA	164L0025		1	N
2	CABLE ECG MARQ. IEC / EU + AS	164L0026		1	N

Table 9-15 ECG Cables (continued)

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
3	LEADWIRES ECG MARQ. AHA/ AMERICA	164L0027		1	N
4	LEADWIRES ECG MARQ. IEC/EU+AS	164L0028		1	N

Table 9-16 Signal Cables

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	CABLE, USB A-B	070D2802		2	1
2	CABLE, ETHERNET CAT-5	070D2902		1	1

Table 9-16 Signal Cables (continued)

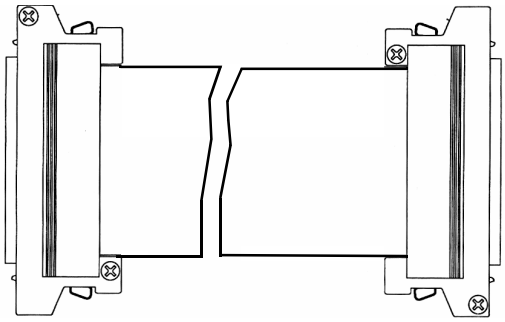
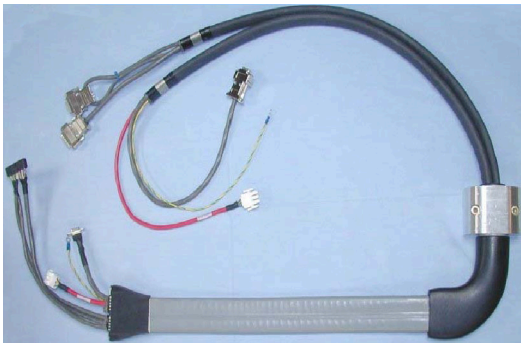
ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
3	CABLE PCI, AMP 974298	070M0016	BEP-PCI slot to Card Rack-IP Module 	1	1
4	CABLE S-VIDEO 1	FC200041	IIO-A10 to VCR IN 	1	1
5	CABLE S-VIDEO 2	FC200042	IIO-A11 to VCR OUT 	1	1
6	CABLE PHONO 1	FC200043	IIO-A6/A7 to VCR IN CH1(L)/CH2(R) 	1	1
7	CABLE PHONO 2	FC200044	IIO-A8/A9 to VCR OUT CH1(L)/CH2(R) 	1	1
8	CABLE, CONSOLE, ASSY COMPLETE	FB200320	Top Console and Monitor to IIO, AC ctrl, BEP and Gas Spring 	1	1

Table 9-16 Signal Cables (continued)

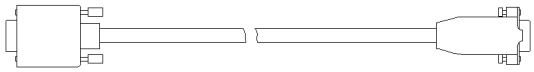
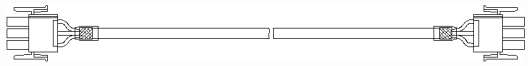
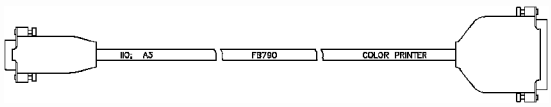
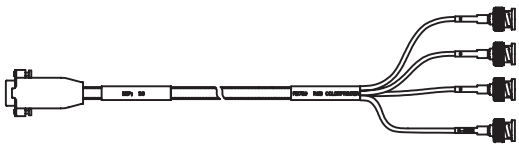
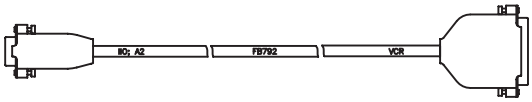
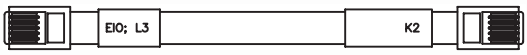
ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
9	CABLE, MONITOR VGA	FB200836		1	1
10	CABLE, MONITOR POWER	FB200837		1	1
11	CABLE, AUDIO INTERNAL I/O-PC	FB200748	IIO-B4 to BEP-AUD 	1	1
12	CABLE, COLOR PRINTER CTRL.	FB200790	IIO-A3 to Color Printer (RS232) 	1	1
13	CABLE COLOR PRINTER VIDEO	FB200789	BEP-D5 to RGB Color Printer 	1	1
14	CABLE BW/CP PRINTER	FB200791	IIO-A1 to BW/Color Printer 	1	1
15	CABLE VCR REMOTE CTRL.	FB200792	Cable VCR remote Controller IIO-A2 to VCR 	1	1
16	CABLE, DOPPLER	FB200793	Doppler Connector to FEP-G1 	1	1

Table 9-16 Signal Cables (continued)

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
17	CABLE, STD. MODEM	FB200794	Modem to EIO-L2 	1	1
18	Modem Line Cable	FC200032	EIO-L3 to Modem 	1	?
19	CABLE, FAN SPEED CTRL.	FB200795	Cable, Fan Speed Controller. IIO-A15 to ACP-F8 	1	1
20	CABLE, MON. STD.	FB200796	BEP-C13 to BEP-D3 	1	1
21	CABLE, RS232 COM 1/2	FB200797	IIO-C6 to BEP-C6 or IIO-B8 to BEP-C7 	1	1
22	CABLE POWER/CTRL INT I/O PC2 I/O	FB200798	Cable, Power/Controller. Internal I/O-PC2IO IIO-B6 to BEP-D2 	1	1
23	CABLE, SIGNALS INT I/O-PC2IO	FB200799	Cable, Signals Internal I/O-PC2IO BEP-D1 to IIO-B5 	1	1

Section 9-14
Electrical Part

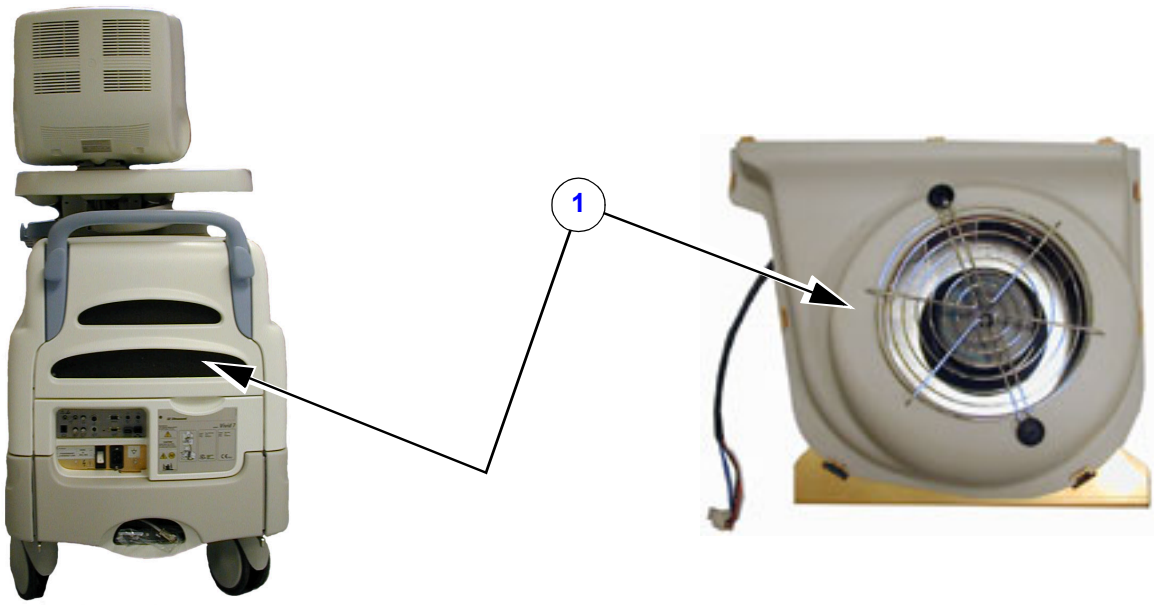


Figure 9-14 Fan Assembly

Table 9-17 Fan Assembly

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	FAN ASSEMBLY COMPLETE	FB200580	FAN ASSEMBLY COMPLETE	1	1

Section 9-15
Backend Processor

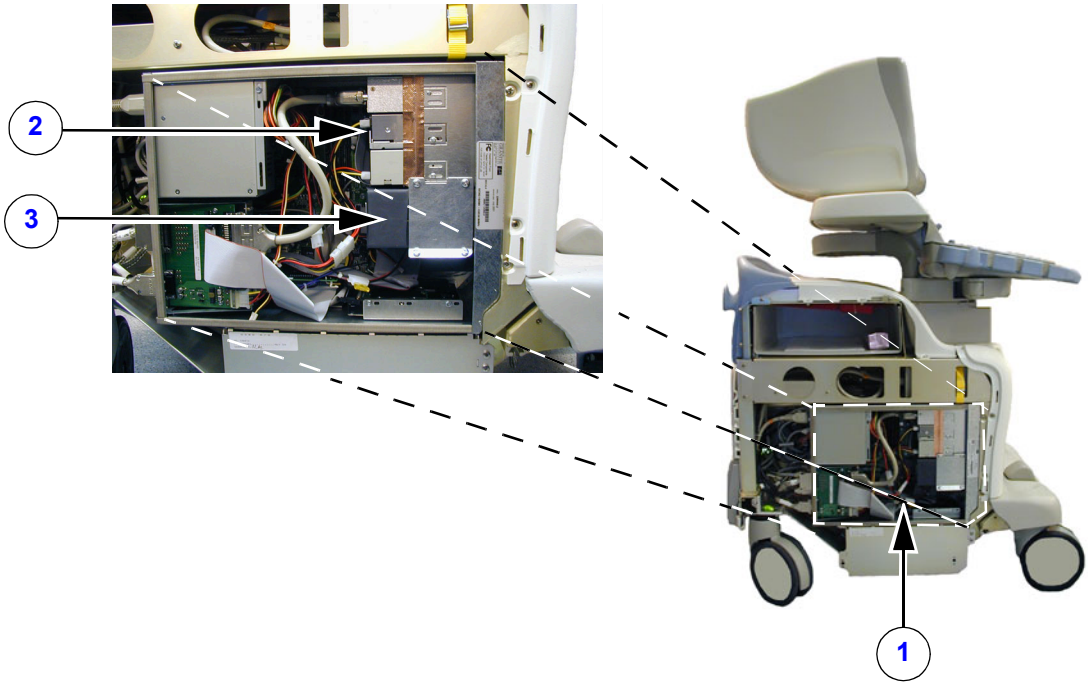


Figure 9-15 Backend Processor Parts

Table 9-18 Backend Processor Parts

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	BEP (BACKEND PROCESSOR)	See Below	See Below	1	1
	BEP WITHOUT MO DRIVE	2266548	Backend Processor without Magneto Optical Drive		
	BEP WITH MO DRIVE	2266548-2	Backend Processor Complete, with 9.1 GB, 5 1/4" Magneto Optical Drive		
2	MO DRIVE, 9,1 GB	066E0676		1	N
3	BATTERY ASSY FOR PC / BEP	2266548-5		1	2

Section 9-16
Peripherals

9-16-1 Printers On Board

Table 9-19 Printers On Board

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	SONY UP-895MDW	2288502	SONY B/W PRINTER	1	1
2	SONY UP21MD	066E2955	COLOR PRINTER UP21MD ASSEMBLY	1	1
3	SONY UP2950MD	066E2950	PRINTER UP-2950MD (INCL.MAN) 100-220V, NTSC/PAL	1	1

9-16-2 Network Printers

Table 9-20 Network Printers

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	Epson 980N	066E0383	USB & Network printer 110V	1	N
2	Epson 980N	066E0384	USB & Network printer 220V		N
3	HP DESKJET 990 CXI, 110V PC	EP100422	Network Printer		1
4	HP DESKJET 990 CXI, 230V PC	EP100423	Network Printer		1

9-16-3 Video Cassette Recorder (VCR)

Table 9-21 VCRs used for Vivid 7/Vivid 7 PRO

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	SONY SVO9500MDP2	066E9510	SUPER-VHS, PAL Needs software v.2.0 (BT'02)	1	1
2	SONY SVO9500MD	066E9511	SUPER-VHS, NTSC Needs software v.2.0 (BT'02)		1
3	PANASONICS AG-MD835E	066E0836	SUPER-VHS, PAL		1
4	PANASONICS AG-MD835P	066E0835	SUPER-VHS, NTSC		1

9-16-4 Footswitch

Table 9-22 Footswitch

ITEM	Part Name	Part Number	Description	QTY	FRU
1	Footswitch	FB200952	FOOTSWITCH 3-PEDALS IP68	1	2

9-16-5 Modem



Figure 9-16 Modem with AC Converter and Cables

Table 9-23 Modem

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	MODEM (MULTITECH) NEW GLOBAL	2245794		1	1

Section 9-17
Probes

Table 9-24 Supported Probes and SW Versions

PROBES	PART NUMBER	NAME	SUPPORTED MODELS & SW VERSION		
			BT-01	BT-02	BT-02 PRO
SECTOR					
3S (Probe, Sector 3S)	2252157	3S PROBE, L500	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
3S, Comfort Scan Probe	2323337	3S COMFORTSCAN PROBE	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
M3s (Probe, AMA Sector M3s)	2295649	2295649 M3S AMA SECT.	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	----------
5S (Probe, Sector 5S)	2290751	5S SECTOR TRANSDUCER	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
7S (Probe, Sector 7S)	2263669	7S PROBE	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
10S (Probe, Sector 10S)	2298589	10 S SECTOR TRANSDUCER	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
PAMPTE					
6T (Probe, TEE 6T)	KN100022	KN100022 6T TEE PROBE	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
8T (Probe, TEE 8T)	KN100023	KN100023 8T PED.TEE PROBE	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
LINEAR & CONVEX & OTHERS					
7L (Probe, Linear 7L)	2294521	7L PROBE TYPE (EXP)	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
10L (Probe, Linear 10L)	2294523	10L PROBE TYPE (EXP)	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
12L (Probe, Linear 12L)	2295377	12L PROBE TYPE (EXP)	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
M12L	2294511	M12L MIH PROBE	----------	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
3.5 C (Probe, Convex 3C)	2296158	3.5C CONVEX TRANSDUCER	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
5C (Probe, Convex 5C)	2294516	5C PROBE TYPE (EXP)	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
i13L	KW100011	KW011 I13L INTRAOP.PROBE	----------	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
E8C	2294641	E8C PROBE	----------	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
PENCIL					
P2D Pencil Probe	TE100024	TE100024 PENCIL PROBE 2D	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x
P6D Pencil Probe	TQ100002	TQ100002 PENCIL PROBE 6D	BT-01 SW ver. 1.x.x	BT-02 SW VER. 2.x.x	BT-02 SW VER. 2.x.x

Section 9-18
Software

Table 9-25 Software used on BT'02

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	Vivid 7, System SW CD, BEP-2	FC200265	Vivid 7/Vivid 7 PRO, System SW installation CD, Disk 1 of 2. (Ghost CD)	1	2
2	Vivid 7, System SW CD, BEP-1	FC200165	Vivid 7/Vivid 7 PRO, System SW installation CD, Disk 1 of 2. (Ghost CD)	1	2
3	Application CD	FC200220	Application SW Installation CD, Disk 2 of 2	1	2

Table 9-26 Software used on BT'01

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	VIVID 7 SYSTEM SW CD v.1.1.x	FC200165	"Ghost CD" with support for HP DESKJET 990 CXI network printer	1	2
2	Application CD v.1.x.x	FC200090	Application SW Installation CD, Disk 2 of 2	1	2

Section 9-19
Options

Table 9-27 Options - Vivid 7 PRO, BT'02

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	Contrast	FC200162		-	-
2	Stress	FB200839		-	-
3	Dicom	FB200849	(DICOM via network)	-	-
4	QAnalysis	FC200164			

Table 9-28 Options - Vivid 7, BT'02

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	Contrast	FC200162		-	-
2	Stress	FB200839		-	-
3	Dicom	FB200849	(DICOM via network)	-	-
4	Strain	FC200163		-	-
5	Strain Japan	FC200171			
6	QAnalysis	FC200164			

Table 9-29 Options - Vivid 7, BT'01

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	Contrast	FB200842		-	-
2	Stress	FB200839		-	-
3	Tissue Tracking	FB200841		-	-
4	Archive	FB200838		-	-
5	Dicom	FB200849	(Dicom via network)	-	-

Section 9-20
Kits

Table 9-30 Kits, Overview

Item	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	BUMPER KIT FROGLEG	FC200086	BUMPER KIT, FROGLEG	1	1
2	COLUMN COVER KIT	FC200183	COLUMN COVER KIT (Same as FC200088)	1	1
3	KNOB KIT	2188902-8	ROUND KNOBS ON OPERATOR PANEL	1	1

9-20-1 Parts Lists for Bumper Kit, Frogleg (Vivid 7 ONLY)

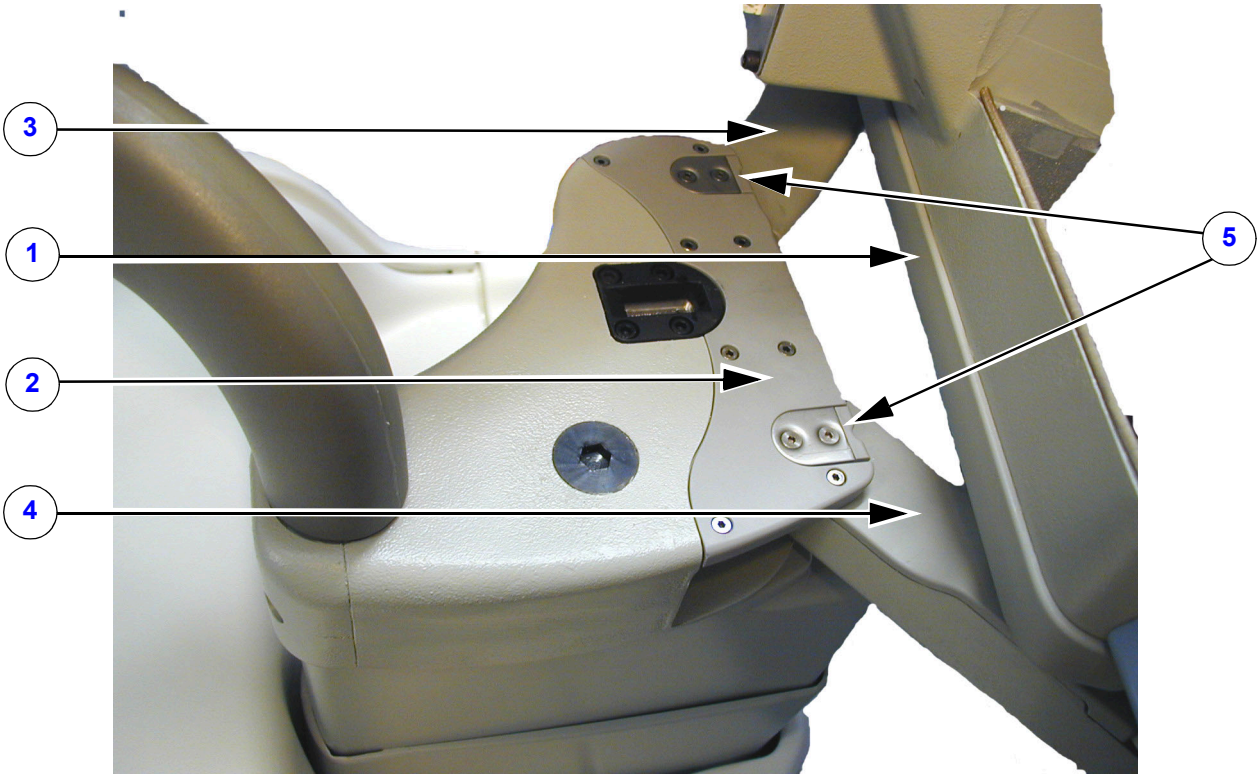


Figure 9-17 Bumper Kit, Frogleg, Base Seen From Above

Table 9-31 Bumper Kit, Frogleg

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	BUMPER CRASH PAD	-	Bumper Crash Rear	1	N
2	BUMPER INNER BOSS	-	-	1	N
3	BUMPER RIGHT FROGLEG	-	-	1	N
4	BUMPER LEFT FROGLEG	-	-	1	N
5	BUMPER INNER BOSS CRASH	-	-	2	N

9-20-2 Parts Lists for Column Cover Kit

Table 9-32 Column Cover Kit

ITEM	PART NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	Cover, Column, Lower	-	-	1	N
2	Cover, Column, Upper	-	-	1	N

Section 9-21
Accessory Box, Vivid 7 / Vivid 7 PRO



Figure 9-18 Accessory Box, Vivid 7/Vivid 7 PRO

Table 9-33 Accessory Box, Vivid 7/Vivid 7 PRO

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	ACCESSORY BOX, VIVID 7, US	FC200038		1	N
2	ACCESSORY BOX, VIVID 7, EUR.	FC200037		1	N

Table 9-34 Vivid 7 Accessory Box Contents (also used for Vivid 7 PRO)

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	Vivid 7 Service Manual, English	FC091194	This manual	1	N
2	Gel Ultrasound Bluescan	098B2001	Bottle	1	N
3	MO Disk	066E0519	Optional	1	N
4	Cable ECG Marquette IEC	164L0026	All countries except USA	1	N
5	Leadwires ECG Marquette IEC	164L0028	All countries except USA	1	N

Table 9-34 Vivid 7 Accessory Box Contents (also used for Vivid 7 PRO) (continued)

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
6	Power Cable	070C3194	All countries except USA	1	N
7	Cable ECG Marquette AHA	164L0025	USA only	1	N
8	Leadwires ECG Marquette AHA	164L0027	USA only	1	N
9	Power Cable	070C3193	USA only	1	N
10	Vivid 7 PRO User Manual Update	FC093202	Multi-language (Not needed for English V7USER MAN)	1	N
11	User Manual, Vivid 7, English	FB092820	V7 USER MAN.	1	N
	User Manual, Vivid 7, German	FB092821	V7 USER MAN.		N
	User Manual, Vivid 7, French	FB092822	V7 USER MAN.		N
	User Manual, Vivid 7, Italian	FB092823	V7 USER MAN.		N
	User Manual, Vivid 7, Spanish	FB092824	V7 USER MAN.		N
	User Manual, Vivid 7, Portuguese	FB092825	V7 USER MAN.		N
	User Manual, Vivid 7, Swedish	FB092866	V7 USER MAN.		N
	User Manual, Vivid 7, Norwegian	FB092867	V7 USER MAN.		N
	User Manual, Vivid 7, Danish	FB092868	V7 USER MAN.		N
	User Manual, Vivid 7, Dutch	FB092869	V7 USER MAN.		N
	User Manual, Vivid 7, Greek	FB092870	V7 USER MAN.		N
	User Manual, Vivid 7, Russian	FB092871	V7 USER MAN.		N
	User Manual, Vivid 7, Turkish	FB092872	V7 USER MAN.		N
	User Manual, Vivid 7, Japanese	FB092873	V7 USER MAN.		N
	User Manual, Vivid 7, Chinese	FB092874	V7 USER MAN.		N
	User Manual, Vivid 7, Polish	FB092875	V7 USER MAN.		N
	User Manual, Vivid 7, Hungarian	FB092877	V7 USER MAN.		N
	User Manual, Vivid 7, Finnish	FB092958	V7 USER MAN		N
12	Reference Manual Volume 2	FB092888	V7 REFERENCE MAN	1	N
13	Probe User Manual(s)	As Required			N

Section 9-22
Accessory Box, SERVICE V7, US

Table 9-35 Accessory Box, SERVICE V7, US, Part Number FC200111

ITEM	NAME	PART NUMBER	DESCRIPTION	QTY	FRU
1	VIVID7 USER MANUAL, ENGLISH	FB092820	Covers both Vivid 7 and Vivid 7 PRO	1	N
2	V7 SYSTEM- AND APPL. SW CDs - V7 SYSTEM SW CD - V7 SYSTEM SW UPGRADE CD - VIVID 7 & ECHOPAC PC APPL. SW	FC200229 - - -	 Part of FC200229 Part of FC200229 Part of FC200229	1	N
3	VIVID7 USER REFER. MANUAL VOL2	FB092888		1	N
4	GEL ULTRASOUND BLUESCAN	098B2001		1	N
5	DISK FOR MO-DRIVE 5.2 GB	066E0519		1	N
6	CABLE ECG MARQUETTE AHA	164L0025		1	N
7	LEADWIRES ECG MARQUETTE AHA	164L0027		1	N
8	CABLE MAINS 3,5M 3*1.90MM2	070C3193		1	N

Section 9-23
Packing Parts for Reshipment



Figure 9-19 Packing Material

Table 9-36 Packing Material for Vivid 7 / Vivid 7 PRO Reshipment

ITEM	DESCRIPTION	PART NUMBER	COMMENTS
1	Rear Stop Bumper	N/A	**Re-shipping:** Re-use the original wooden box and other packing materials used for shipment
2	Front Stop Bumper	N/A	
3	Front Panel Reinforcement	N/A	
4	Shelf Reinforcement	N/A	
5	Wedge	N/A	
6	Monitor Reinforcement	N/A	
7	Pink plate	N/A	
8	Wooden Shelf	N/A	
9	Wooden box	N/A	
	Plastic Foil	N/A	To wrap around the unit

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Chapter 10
Periodic Maintenance

Section 10-1
Overview

10-1-1 Purpose of Chapter 10

This chapter describes Periodic Maintenance (PM) on the scanner and its peripherals. These PM procedures are intended to maintain the quality of the ultrasound systems performance. Read this chapter completely and familiarize yourself with the procedures before starting a PM.

Table 10-1 Contents in Chapter 10

Section	Description	Page Number
10-1	Overview	10-1
10-2	Why do Periodic Maintenance	10-2
10-3	Periodic Maintenance Schedule	10-2
10-4	Tools Required	10-4
10-5	System Periodic Maintenance	10-5
10-6	Using a Phantom	10-10
10-7	Electrical Safety Tests	10-10
10-8	When There's Too Much Leakage Current...	10-23
	PM Inspection Certificate	10-29

CAUTION **Practice good ESD prevention. Wear an anti–static strap when handling electronic parts and even when disconnecting/connecting cables.**

DANGER **THERE ARE SEVERAL PLACES ON THE BACKPLANE, THE AC DISTRIBUTION, AND DC DISTRIBUTION THAT ARE DANGEROUS. BE SURE TO DISCONNECT THE SYSTEM POWER PLUG AND OPEN THE MAIN CIRCUIT BREAKER BEFORE YOU REMOVE ANY PARTS. BE CAUTIOUS WHENEVER POWER IS STILL ON AND COVERS ARE REMOVED.**

CAUTION **Do not pull out or insert circuit boards while power is ON.**

CAUTION **Do not operate this unit unless all board covers and frame panels are securely in place. System performance and cooling require this.**

Section 10-2
Why do Periodic Maintenance

10-2-1 Keeping Records

It is good business practice that ultrasound facilities maintain records of periodic and corrective maintenance. The Ultrasound Periodic Maintenance Inspection Certificate provides the customer with documentation that the ultrasound scanner is maintained on a periodic basis.

A copy of the Ultrasound Periodic Maintenance Inspection Certificate should be kept in the same room or near the scanner.

10-2-2 Quality Assurance

In order to gain accreditation from organizations such as the American College of Radiology (USA), it is the customer's responsibility to have a quality assurance program in place for each scanner. The program must be directed by a medical physicists, the supervising radiologist/physician or appropriate designee.

Routine quality control testing must occur regularly. The same tests are performed during each period so that changes can be monitored over time and effective corrective action can be taken.

Testing results, corrective action and the effects of corrective action must be documented and maintained on the site.

Your GE service representative can help you with establishing, performing and maintaining records for a quality assurance program.

Section 10-3
Periodic Maintenance Schedule

10-3-1 How often should PMs be performed?

The Periodic Maintenance Schedule specifies how often your Vivid 7 / Vivid 7 PRO should be serviced and what items need attention. It is the customer's responsibility to ensure the Vivid 7 / Vivid 7 PRO periodic maintenance is performed as scheduled in order to retain its high level of safety, dependability and performance.

Your GE Service Representative knows your Vivid 7 / Vivid 7 PRO best and can provide competent, efficient service. Please contact us for further information and to schedule GE Medical Systems Ultrasound to perform this service for you.

The services and intervals shown in the maintenance schedule assumes that you use your Vivid 7 / Vivid 7 PRO for an average patient load (10-12 per day) and not use it as a primary mobile unit which is transported between diagnostic facilities.

If conditions exist which exceed typical usage and patient load, then it is recommended to increase the periodic maintenance frequencies.

.

Table 10-2 Periodic Maintenance Schedule

Service at Indicated Time	Daily	Weekly	Monthly	Annually	Notes
Clean Probes	•*				* or before each use
Clean Probe Holders	•				
Clean Air Filter		•			more frequently depending on your environment
Inspect AC Mains Cable			•		Mobile Unit Check Weekly
Inspect Cables and Connectors			•		
Clean Console			•		
Clean Monitor and Touch Panel			•		
Inspect Wheels, Casters, brakes and Swivel Locks			•		Mobile Unit Check Daily
Check Control Panel Movement			•		Mobile Unit Check Daily
Console Leakage Current Checks				•	also after corrective maintenance or as required by your facilities QA program
Peripheral Leakage Current Checks				•	also after corrective maintenance or as required by your facilities QA program
Surface Probe Leakage Current Checks				•	also after corrective maintenance or as required by your facilities QA program
Endocavity Probe Leakage Current Checks					**Twice Annually**
Transesphongeal Probe Leakage Current Checks					**As Prescribed in probe manual**
Surgical Probe Leakage Current Checks					**As Prescribed in probe manual**
Measurement Accuracy Checks				•	also after corrective maintenance or as required by your facilities QA program
Probe/Phantom Checks				•	also after corrective maintenance or as required by your facilities QA program
Functional Checks				•	also after corrective maintenance or as required by your facilities QA program

Section 10-4
Tools Required

10-4-1 Special Tools, Supplies and Equipment

10-4-1-1 Specific Requirements for Periodic Maintenance

See Chapter 7

Table 10-3 Overview of Requirements for Periodic Maintenance

Tool	Part Number	Comments
Digital Volt Meter (DVM)		
Anti Static Kit	46–194427P231 46–194427P279 46–194427P369 46–194427P373 46–194427P370	Kit includes anti–static mat, wrist strap and cables for 200 to 240 V system 3M #2204 Large adjustable wrist strap 3M #2214 Small adjustable wrist strap 3M #3051 conductive ground cord
Anti Static Vacuum Cleaner	46–194427P278 46–194427P279	120V 230V
Air Filter		air intake
Safety Analyzer	46–285652G1	DALE 600 KIT (or equivalent) for electrical tests
SVHS VCR Cassette	E7010GG E7010GF	60 minute 120 minute
SVHS VCR Head Cleaner		See VCR user manual for requirements
3.5” MOD MEDIA	E8381AA E8381AB	blank 128 M disk blank 230 M disk
3.5” MOD Media Cleaner	2117811	cleans the diskettes
3.5” MOD Head Cleaner Kit	2148392	cleans the drive heads
QIQ Phantom	E8370RB	RMI Grayscale Target Model 403GS
B/W Printer Cleaning Sheet		See printer user manual for requirements
Color Printer Cleaning Sheet		See printer user manual for requirements
Disposable Gloves		

Section 10-5
System Periodic Maintenance

10-5-1 Preliminary Checks

The preliminary checks take about 15 minutes to perform. Refer to the system user documentation whenever necessary.

Table 10-4 System Preliminary Checks

Step	Item	Description
1	Ask & Listen	Ask the customer if they have any problems or questions about the equipment.
2	Paperwork	Fill in the top of the Periodic Maintenance (PM) Inspection Certificate. Note all probes and system options.
3	Power up	Turn the system power on and verify that all fans and peripherals turn on. Watch the displays during power up to verify that no warning or error messages are displayed.
4	Probes	Verify that the system properly recognizes all probes.
5	Displays	Verify proper display on the monitor and touch panel.
6	Presets	Backup all customer presets on a CD-R.

10-5-2 Functional Checks (See Also Chapter 4)

The functional checks take about 60 minutes to perform. Refer to the system user documentation whenever necessary.

10-5-2-1 System Checks

Table 10-5 System Functional Checks

Check	Step	Description
	B-Mode	Verify basic B-Mode (2D) operation. Check the basic system controls that affect this mode of operation.
	CF-Mode	Verify basic CF-Mode (Color Flow Mode) operation. Check the basic system controls that affect this mode of operation.
	Doppler Modes	Verify basic Doppler operation (PW and CW if available). Check the basic system controls that affect this mode of operation.
	M-Mode	Verify basic M-Mode operation. Check the basic system controls that affect this mode of operation.
	*Applicable Software Options	Verify the basic operation of all optional modes such as Multi-Image, Contrast, Harmonics, Cine, Stress Echo,... etc. Check the basic system controls that affect each options operation.
	Probe Elements	Perform an Element Test, see section 7-4-3 on page 7-60, on each probe to verify that all probe elements (and system channels) are functional.
	System Diagnostic	Perform the Automatic Tests, see section Section 7-4 on page 7-59, to verify that all boards function according to specifications.
	Control Panel Test	Perform the Control Panel Test Procedure, see section 7-3-3-1 on page 7-53, to verify that all keyboard controls are OK. This is performed by the internal PC (backend processor) which does a normal keyboard run through.
	Monitor	Verify basic Monitor display functions. Refer to Chapter 3 of the User Manual.
	Touch Panel	Verify basic Touch Panel display functions. Refer to Chapter 3 of the User Manual.
	Measurements	Scan a gray scale phantom and use the measurement controls to verify distance and area calculation accuracy. Refer to the User Manual, Chapter 18, for measurement accuracy specifications.

*NOTE: * Some software may be considered standard depending upon system model configuration.*

10-5-2-2 Peripheral/Option Checks

If any peripherals or options are not part of the system configuration, the check can be omitted. Refer to the User Manual for a list of approved peripherals/options.

Table 10-6 GE Approved Peripheral/Hardware Option Functional Checks

Step	Item	Description
1	VCR	Verify record/playback capabilities of the VCR. Clean heads and covers if necessary.
2	B/W Printer	Verify hardcopy output of the B/W video page printer. Clean heads and covers if necessary.
3	Color Printer	Verify hardcopy output of the Color video page printer. Clean heads and covers if necessary.
4	DICOM	Verify that DICOM is functioning properly. Send an image to a DICOM device.
5	InSite/iLinq	Verify that InSite is functioning properly. Ensure two-way remote communications. (Warranty & Contract Customers only)
7	Footswitch	Verify that the footswitch is functioning as programed. Clean as necessary.
8	ECG	Verify basic operation with customer

10-5-3 Input Power

10-5-3-1 Mains Cable Inspection

Table 10-7 Mains Cable Inspection

Step	Item	Description
1	Unplug Cord	Disconnect the mains cable from the wall and system.
2	Inspect	Inspect it and its connectors for damage of any kinds.
3	Verify	Verify that the LINE, NEUTRAL and GROUND wires are properly attached to the terminals, and that no strands may cause a short circuit.
4	Verify	Inlet connector retainer is functional.

10-5-4 Cleaning

10-5-4-1 General Cleaning

Table 10-8 General Cleaning

Step	Item	Description
1	Console	Use a fluid detergent in warm water on a soft, damp cloth to carefully wipe the entire system. Be careful not to get the cloth too wet so that moisture does not enter the console.
2	Probe Holder	Clean probe holders. (they may need to be soaked to remove excess gel).

10-5-4-2 Air Filter Cleaning

Table 10-9 Air Filter Cleaning - frequency varies with your environment

Step	Item	Description
1	Remove Filter Cover	Refer to Chapter 8 for air filter location and removal instructions
2	Clean Filter	The filters can be cleaned in sprinkling water, or they can be dusted with a vacuum cleaner. If the filter is metal wash and/or vacuum. If the filter is fiber or plastic vacuum or replace
3	Install Filter	Install the clean filter.

NOTE: For your convenience or of the air filter is too dirty, replacement filters are available. Refer to Chapter 9 for the air filter replacement part number.

10-5-5 Physical Inspection

Table 10-10 Physical Checks

Step	Item	Description
1	Labeling	Verify that all system labeling is present and in readable condition.
2	Scratches & Dents	Inspect the console for dents, scratches or cracks.
3	Control Panel	Inspect keyboard and control panel. Note any damaged or missing items.
4	Control Panel Movement	Verify ease of control panel (Operator I/O Panel) movement in all acceptable directions. Ensure that it latches in position as required.
5	Wheels & Brakes	Check all wheels and casters for wear and verify operation of foot brake, to stop the unit from moving, and release mechanism. Check all wheel locks and wheel swivel locks for proper operation.
6	Cables & Connectors	Check all internal cable harnesses and connectors for wear and secure connector seating. Pay special attention to footswitch assembly and probe strain or bend reliefs.
7	Shielding & Covers	Check to ensure that all EMI shielding, internal covers, air flow panels and screws are in place. Missing covers and hardware could cause EMI/RFI problems while scanning.
8	External I/O	Check all connectors for damage and verify that the labeling is good.
9	Op Panel Lights	Check for proper operation of all operator panel and TCG lights.
10	Monitor Light	Check for proper operation of any monitor lights and/or
11	External Microphone	Check for proper operation of any external microphones by recording an audio test.

10-5-6 Optional Diagnostic Checks

To complete the PM checks, access the diagnostic software as described in Chapters 5 or 7. View the error logs and run desired diagnostics.

10-5-6-1 View the Logs

1.) Review the system error log for any problems.

2.) Check the temperature log to see if there are any trends that could cause problems in the future.

10-5-7 Probe Maintenance

10-5-7-1 Probe Related Checks

Table 10-11 Probe Related Checks

Step	Item	Description
1	Probe Holder	Clean probe holders. (they may need to be soaked to remove excess gel).
2	Probes	Thoroughly check the system probe connectors and remove dust from inside the connector sockets if necessary. Visually check for bent, damaged or missing pins

10-5-7-2 Basic Probe Care

The system user manuals and various probe handling cards provide a complete description of probe care, maintenance, cleaning and disinfection. Ensure that you are completely familiar with the proper care of GE probes.

Ultrasound probes can be easily damaged by improper handling. See the User Manual and probe care cards for more details. Failure to follow these precautions can result in serious injury and equipment damage. Failure to properly handle or maintain a probe may also void its warranty.

Any evidence of wear indicates the probe cannot be used.

Do a visual check of the probe pins and system sockets before plugging in a probe.

TEE and Interoperative probes often have special considerations and individual probe user manuals. For TEE and Interoperative probes also refer to their separate user manuals.

10-5-7-3 Basic Probe Cleaning

Refer to the User's Manual for details on probe cleaning.

CAUTION **To help protect yourself from blood borne diseases, wear approved disposable gloves. These are made of nitrile derived from vegetable starch to prevent allergic latex reactions.**

CAUTION **Failure to follow the prescribed cleaning or disinfection procedures will void the probe's warranty. DO NOT soak or wipe the lens with any product not listed in the User Manual. Doing so could result in irreparable damage to the probe. Follow care instructions that came with the probe.**

CAUTION **Disinfect a defective probe before you return it. Be sure to tag the probe as being disinfected.**

Section 10-6
Using a Phantom

See the Basic User Manual "*Customer Maintenance*" for information on using a phantom and quality assurance tests.

Section 10-7
Electrical Safety Tests

10-7-1 Safety Test Overview

The electrical safety tests in this section are based on and conform to NFPA 99 (For USA) and IEC 60601-1 Medical Equipment Safety Standards. They are intended for the electrical safety evaluation of cord-connected, electrically operated, patient care equipment. If additional information is needed, refer to the NFPA 99 (For USA) and IEC 60601-1 documents.

⚠ **WARNING** ***THE USER MUST ENSURE THAT THE SAFETY INSPECTIONS ARE PERFORMED AT LEAST EVERY 12 MONTHS ACCORDING TO THE REQUIREMENTS OF THE PATIENT SAFETY STANDARD IEC-EN 60601-1. ONLY TRAINED PERSONS ARE ALLOWED TO PERFORM THE SAFETY INSPECTIONS MENTIONED ABOVE.***

⚠ **CAUTION** **To avoid electrical shock, the unit under test must not be connected to other electrical equipment. Remove all interconnecting cables and wires. The unit under test must not be contacted by users or patients while performing these tests.**

⚠ **CAUTION** **Possible risk of infection. Do not handle soiled or contaminated probes and other components that have been in patient contact. Follow appropriate cleaning and disinfecting procedures before handling the equipment.**

Test the system, peripherals and probes for leakage current. Excessive leakage current can cause injury or death in sensitive patients. High leakage current can also indicate degradation of insulation and a potential for electrical failure. Do not use probes or equipment having excessive leakage current.

To minimize the risk that a probe may shock someone the customer should:

- Not use a probe that is cracked or damaged in any way
- Check probe leakage current:
    * once a year on surface probes
    * twice a year on endocavitary probes
    * whenever probe damage is suspected

10-7-2 GEMS Leakage Current Limits

The following limits are summarized for NFPA 99 (For USA) and IEC 60601-1 Medical Equipment Safety Standards. These limits are GEMS standards and in some cases are lower than the above standards listed.

Table 10-12 Chassis Leakage Current Limits—Accessible Metal Surfaces

Country	Normal Condition	Open Ground	Reverse Polarity	Open Neutral
USA	N/A	0.3 mA	0.3 mA	N/A
Other	0.1 mA	0.5 mA	0.5 mA	0.5 mA

Table 10-13 Type BF Applied Part Leakage Current Limits - Non-Conductive (Floating) Surface and Cavity Probes

Country	Normal Condition	Open Ground	Reverse Polarity	Open Neutral	*Mains Applied
USA	0.05 mA	0.05 mA	0.05 mA	0.05 mA	N/A
Other	0.1 mA	0.5 mA	0.5 mA	0.5 mA	5.0 mA

Table 10-14 Type CF Applied Part Leakage Current Limits - Surgical Probes and ECG Connections

Country	Normal Condition	Open Ground	Reverse Polarity	Open Neutral	*Mains Applied
USA	0.01 mA	0.05mA	0.05 mA	N/A	0.025 mA
Other	0.01 mA	0.05 mA	0.05 mA	0.05 mA	0.05 mA

*NOTE: *Mains Applied refers to the sink leakage test where mains (supply) voltage is applied to the part to determine the amount of current that will pass (or sink) to ground if a patient contacted mains voltage.*

The following tests are performed at the factory and should be performed at the site. These tests are: grounding continuity, chassis leakage current, probe leakage current, and ECG leakage current. All measurements are made with an electrical safety analyzer.

10-7-3 Outlet Test - Wiring Arrangement - USA & Canada

Test all outlets in the area for proper grounding and wiring arrangement by plugging in the neon outlet tester and noting the combination of lights that are illuminated. Any problems found should be reported to the hospital immediately and the receptacle should not be used.

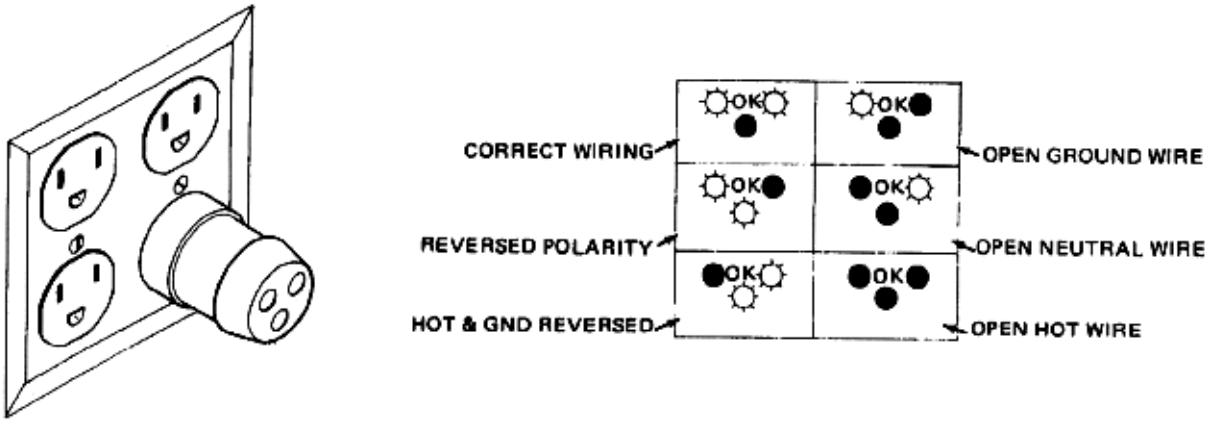


Figure 10-1 Typical Alternate Outlet Tester

NOTE: No outlet tester can detect the condition where the Neutral (grounded supply) conductor and the Grounding (protective earth) conductor are reversed. If later tests indicate high leakage currents, this should be suspected as a possible cause and the outlet wiring should be visually inspected.

10-7-4 Grounding Continuity

⚠ **CAUTION Electric Shock Hazard. The patient must not be contacted to the equipment during this test**

Measure the resistance from the third pin of the attachment plug to the exposed metal parts of the case. The ground wire resistance should be less than **0.2** ohms. Reference the procedure in the IEC 601-1.1.

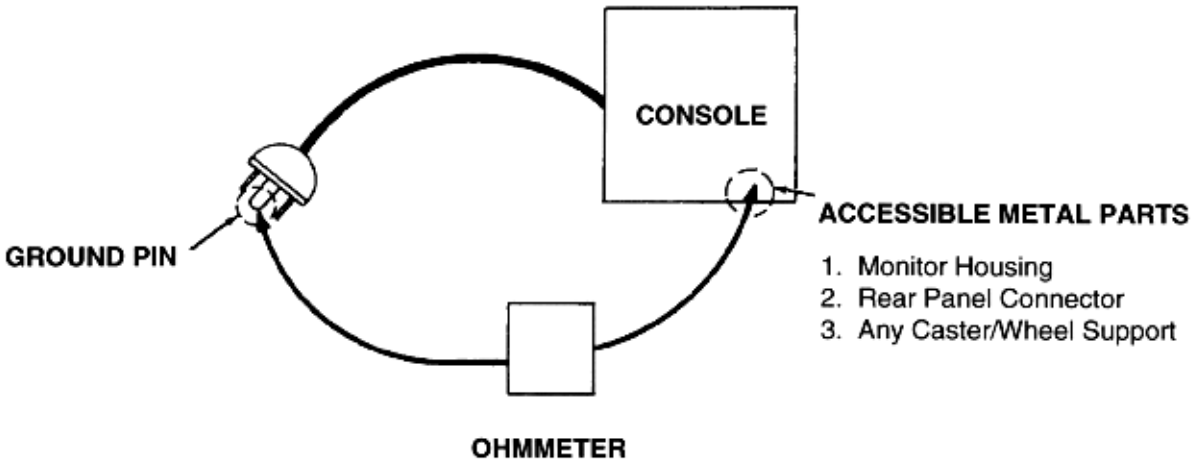


Figure 10-2 Ground Continuity Test

10-7-4-1 Meter Procedure

Follow these steps to test the ground wire resistance.

1.) Turn the Vivid 7 / Vivid 7 PRO unit OFF.
2.) Plug the unit into the meter, and the meter into the tested AC wall outlet.
3.) Plug the black chassis cable into the meter's “CHASSIS” connector and attach the black chassis cable clamp to an exposed metal part of the Vivid 7 / Vivid 7 PRO unit.
4.) Set the meter's “FUNCTION” switch to the RESISTANCE position.
5.) Set the meter's “POLARITY” switch to the OFF (center) position.
6.) Measure and record the ground wire resistance.

10-7-5 Chassis Leakage Current Test

10-7-5-1 Definition

This test measures the current that would flow in a grounded person who touched accessible metal parts of the bedside station if the ground wire should break. The test verifies the isolation of the power line from the chassis. The meter is connected from accessible metal parts of the case to ground. Measurements should be made with the unit On and Off, with the power line polarity Normal and Reversed. Record the highest reading.

CAUTION **Electric Shock Hazard. When the meter's ground switch is OPEN, don't touch the unit!**

CAUTION **Equipment damage possibility. Never switch the Polarity and the status of Neutral when the unit is powered ON. Be sure to turn the unit power OFF before switching them using the POLARITY switch and/or the NEUTRAL switch. Otherwise, the unit may be damaged.**

10-7-5-2 Generic Procedure

The test verifies the isolation of the power line from the chassis. The testing meter is connected from accessible metal parts of the case to ground. Measurements should be made with the unit ON and OFF, with the power line polarity Normal and Reversed. Record the highest reading of current.

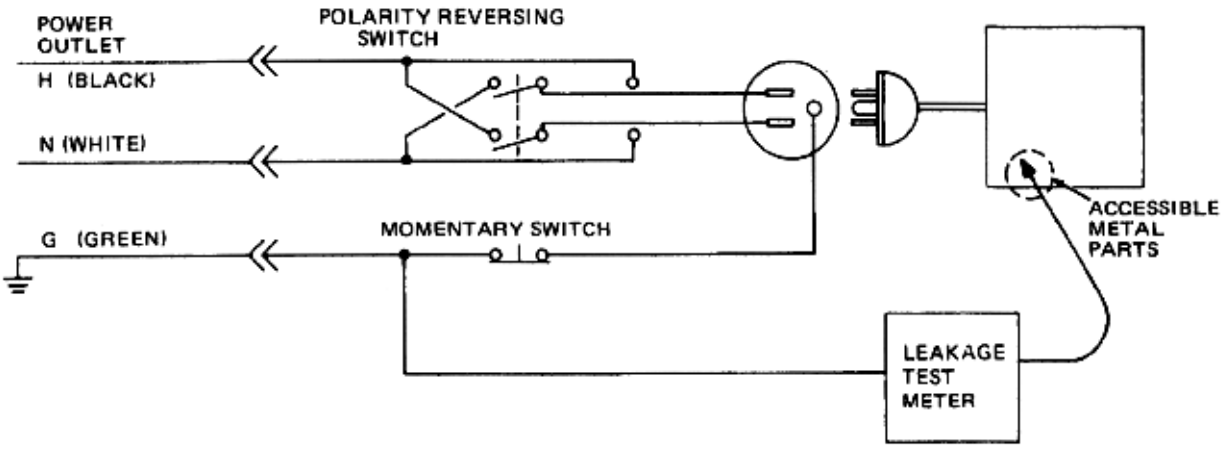


Figure 10-3 Set Up for Chassis Source Leakage Current, IEC 601-1 Clause 19 - Continuos Leakage Currents and Patient, Auxiliary Currents

When using the Microguard or a similar test instrument, its power plug may be inserted into the wall outlet and the equipment under test is plugged into the receptacle on the panel of the meter. This places the meter in the grounding conductor and the current flowing from the case to ground will be indicated in any of the current ranges. The maximum allowable limit for chassis source leakage is shown in Table 10-12.

7.) Follow the test conditions described for respective test points shown in Table 10-15

.

Table 10-15 Chassis Leakage Current Test Condition

TEST	CONDITION
1	Mounting screw for probe receptacle

Table 10-15 Chassis Leakage Current Test Condition

TEST	CONDITION
2	Wheel support
3	Mounting screw for CRT housing
4	Mounting screw for peripheral plugged into unit
5	Mounting screw for other peripheral powered by unit

8.) Keep a record of the results with other hard copies of PM data kept on site.

10-7-5-3 Data Sheet for Chassis Source Leakage Current

The test passes when all readings measure less than the value shown in Table 10-12. Record all data on the PM Inspection Certificate.

Table 10-16 Typical Data Sheet for Chassis Source Leakage Current

Unit Power	Tester Polarity Switch	Tester Neutral or Ground Switch	Test 1 Probe Connector	Test 2 Wheel	Test 3 CRT	Optional Test 4	Optional Test 5
Enter Name of tested peripheral here:							
ON	NORM	OPEN					
ON	NORM	CLOSED					
ON	REV	OPEN					
ON	REV	CLOSED					
OFF	NORM	OPEN					
OFF	NORM	CLOSED					
OFF	REV	OPEN					
OFF	REV	CLOSED					

10-7-6 Isolated Patient Lead (Source) Leakage–Lead to Ground

10-7-6-1 Definition

This test measures the current which would flow to ground from any of the isolated ECG leads. The meter simulates a patient who is connected to the monitoring equipment and is grounded by touching some other grounded surface. Measurements should be made with the ground open and closed, with power line polarity normal and reversed, and with the ultrasound console Off and On. For each combination the operating controls, such as the lead switch, should be operated to find the worst case condition.

⚠ **CAUTION** **Equipment damage possibility. Never switch the Polarity when the unit is powered ON. Be sure to turn the unit power OFF before switching the polarity using the POLARITY switch. Otherwise, the unit may be damaged.**

10-7-6-2 Generic Procedure

Measurements should be made with the ground open and closed, with power line polarity normal and reversed, and with the unit Off and On. For each combination, the operating controls such as the lead switch should be operated to find the worst case condition.

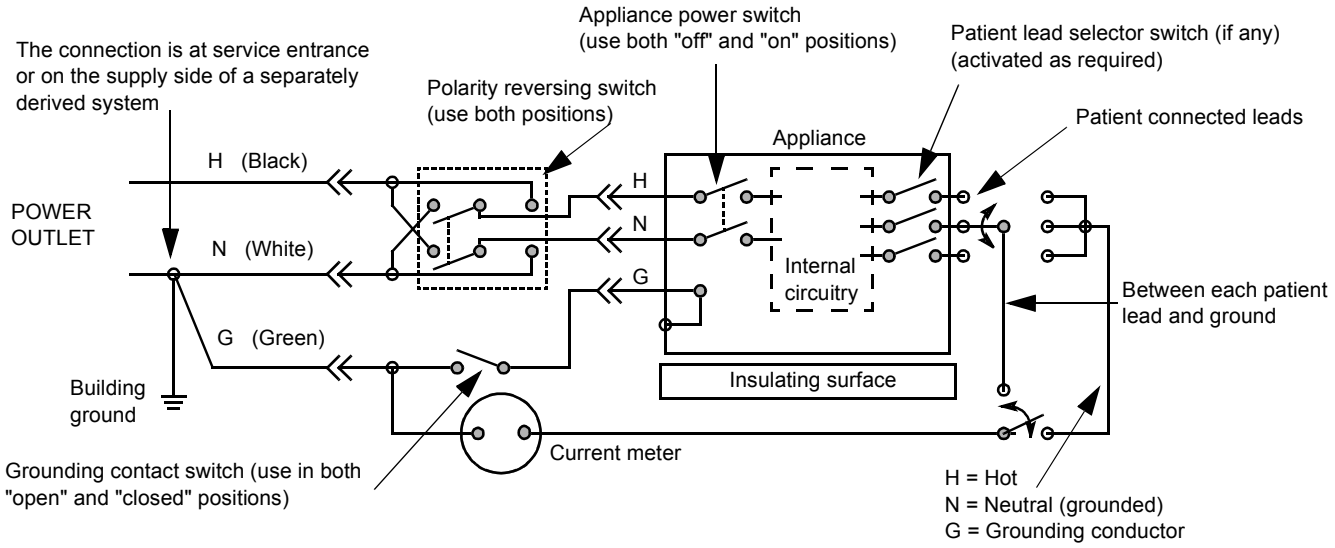

The connection is at service entrance or on the supply side of a separately derived system
Appliance power switch (use both "off" and "on" positions)
Patient lead selector switch (if any) (activated as required)
Polarity reversing switch (use both positions)
Patient connected leads
Appliance
H (Black)
POWER OUTLET
N (White)
H
N
G
Internal circuitry
Between each patient lead and ground
G (Green)
Building ground
Insulating surface
Current meter
Grounding contact switch (use in both "open" and "closed" positions)
H = Hot
N = Neutral (grounded)
G = Grounding conductor

Figure 10-4 Test Circuit for Measuring Non-Isolated Patient Leads

Table 10-17 Testing Power Conditions

ECG Power	Meter's Polarity Switch	Meter's Neutral Switch
ON	NORM	CLOSED
ON	NORM	OPEN
ON	REVERSE	CLOSED
ON	REVERSE	OPEN
OFF	NORM	CLOSED
OFF	NORM	OPEN
OFF	REVERSE	CLOSED
OFF	REVERSE	OPEN

10-7-7 Isolated Patient Lead (Source) Leakage–Lead to Lead

Reference the procedure in the IEC 60601-1. When using the Dale 600, switch the meter's function selector to the LEAD-LEAD position. Select and test each of the five ECG lead positions (except ALL) on the LEAD selector, testing each to the power condition combinations found in the table. Record the highest leakage current measured.

10-7-8 Isolated Patient Lead (Sink) Leakage-Isolation Test

Reference the procedure in the IEC 60601-1. When using the Dale 600, switch the meter's function selector to the LEAD-ISO. Select the ALL position on the lead selector. Depress the rocker switch to ISO TEST to test lead isolation.

⚠ **CAUTION** **Line voltage is applied to the ECG leads during this test. To avoid possible electric shock hazard, the system being tested must not be touched by patients, users or anyone while the ISO TEST switch is depressed.**

NOTE: It is not necessary to test each lead individually or power condition combinations as required in previous tests.

10-7-8-1 Data Sheet for ECG Leakage Current

The test passes when all readings measure less than the value shown in the table below. Record all data on the PM Inspection Certificate.

Table 10-18 Maximum Allowance Limit for ECG Leakage Current

	AC Power Source	Maximum Allowance Limit	
		GROUND OPEN	GROUND CLOSED
Patient Lead to Ground Leakage Current Test and Patient Lead to Lead Leakage Current Test	115V	10uA	10uA
	220/240V	500uA	10uA

Table 10-19 Maximum Allowance Limit for ECG Leakage Current

	AC Power Source	Maximum Allowance Limit
Patient Lead Isolation Current Test	115V	20uA
	220/240V	5mA

Table 10-20 Typical Data Sheet for ECG Leakage Current

ECG Power	Tester Polarity Switch	Tester Ground Switch	Tester Lead Selector				
			RL	RA	LA	LL	C
ON	NORM	CLOSED					
ON	REVERSE	CLOSED					
ON	NORM	OPEN					
ON	REVERSE	OPEN					
OFF	NORM	CLOSED					
OFF	REVERSE	CLOSED					
OFF	NORM	OPEN					
OFF	REVERSE	OPEN					

10-7-9 Probe Leakage Current Test

10-7-9-1 Definition

This test measures the current that would flow to ground from any of the probes through a patient who is being scanned and becomes grounded by touching some other grounded surface.

10-7-9-2 Generic Procedure

Measurements should be made with the ground open and closed, with power line polarity normal and reversed, and with the unit Off and On. For each combination, the probe must be active to find the worst case condition.

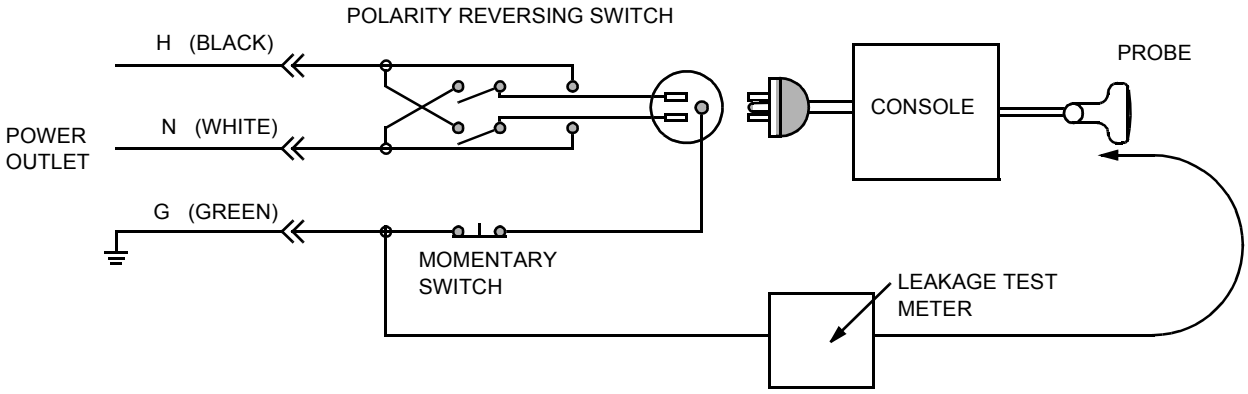


Figure 10-5 Set Up for Probe Leakage Current

NOTE: Each probe will have some amount of leakage current, dependent on its design. Small variations in probe leakage currents are normal from probe to probe. Other variations will result from differences in line voltage and test lead placement.

10-7-9-3 No Meter Probe Adapter Procedure

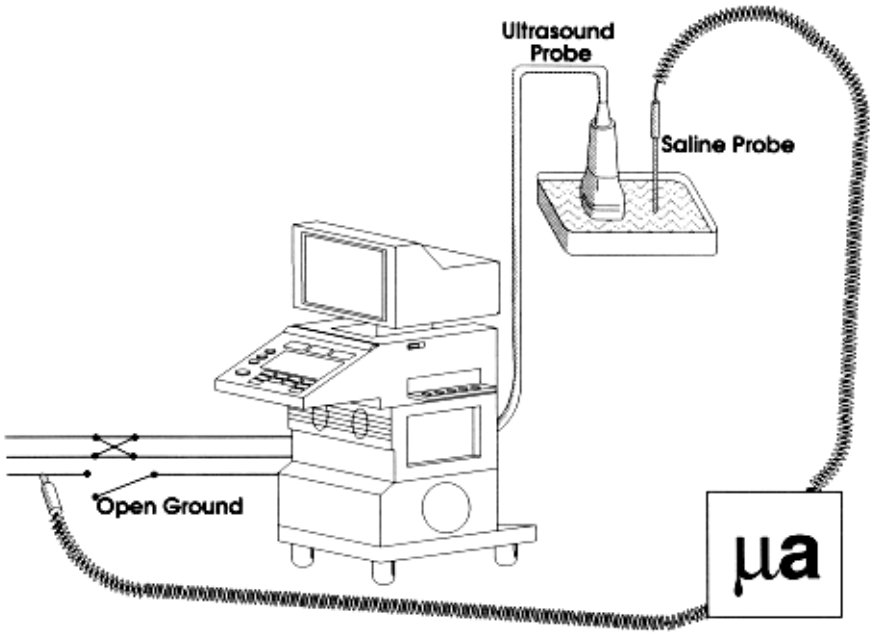


Figure 10-6 No Meter Probe Adapter Procedure

Follow these steps to test each transducer for leakage current.

1.) Turn the Vivid 7 / Vivid 7 PRO unit OFF.
2.) Plug the unit into the test meter, and the meter into the tested AC wall outlet.
3.) Plug the external probe into the meter's “EXTERNAL” connector.
4.) Set the meter's “FUNCTION” switch to EXTERNAL position.
5.) Connect the probe for test with the connector of the console.
6.) Add the saline probe and the imaging area of the probe into the saline bath.
7.) Have unit power ON for the first part; turn it OFF for the second half.
8.) Depress the ISO TEST rocker switch and record the highest current reading.
9.) Follow the test conditions described in Table 10-21 for every transducer.
10.)Keep a record of the results with other hand copies of PM data.

10-7-9-4 Data Sheet for Transducer Source Leakage Current

The test passes when all readings measure less than the values shown in Table 10-13 and Table 10-14. Record all data on the PM Inspection Certificate.

CAUTION **Equipment damage possibility. Never switch the Polarity and the status of Neutral when the unit is powered ON. Be sure to turn the unit power OFF before switching them using the POLARITY switch and/or the NEUTRAL switch. Otherwise, the unit may be damaged**

Table 10-21 Typical Data Sheet For Transducer Source Leakage Current

Transducer Tested:			
Unit Power	**Tester Power Polarity Switch**	**Tester GROUND or NUETRAL Switch**	**Measurement**
ON	NORM	OPEN	
ON	NORM	CLOSED	
ON	REV	OPEN	
ON	REV	CLOSED	
OFF	NORM	OPEN	
OFF	NORM	CLOSED	
OFF	REV	OPEN	
OFF	REV	CLOSED	

Section 10-8
When There's Too Much Leakage Current...

CHASSIS FAILS

Check the ground on the power cord and plug for continuity. Ensure the ground is not broken, frayed, or intermittent. Replace any defective part.

Tighten all grounds. Ensure star washers are under all ground studs.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

NOTE: No outlet tester can detect the condition where the white neutral wire and the green grounding wire are reversed. If later tests indicate high leakage currents, this should be suspected as a possible cause and the outlet wiring should be visually inspected.

PROBE FAILS

Test the probe in another connector to isolate if the fault lies with the probe or the scanner.

NOTE: Each probe will have some amount of leakage, dependent on its design. Small variations in probe leakage currents are normal from probe to probe. Other variations will result from differences in line voltage and test lead placement. The maximum allowable leakage current for body surface contact probe differs from inter-cavity probe. Be sure to enter the correct probe type in the appropriate space on the check list.

If excessive leakage current is slot dependent, inspect the system connector for bent pins, poor connections, and ground continuity.

If the problem remains with the probe, replace the probe.

PERIPHERAL FAILS

Tighten all grounds. Ensure star washers are under all ground studs.

Inspect wiring for bad crimps, poor connections, or damage.

STILL FAILS

If all else fails, begin isolation by removing the probes, external peripherals, then the on board ones, one at a time while monitoring the leakage current measurement.

NEW UNIT

If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

ECG FAILS

Inspect cables for damage or poor connections

PM INSPECTION CERTIFICATE

Customer Name:		System ID:	Dispatch Number / Date Performed:	Warranty/Contract/HBS
System Type		Model Number:	Serial Number:	Manufacture Date:
Probe 1:	Frequency:	Scan Format*:	Model Number:	Serial Number:
Probe 2:	Frequency:	Scan Format*:	Model Number:	Serial Number:
Probe 3:	Frequency:	Scan Format*:	Model Number:	Serial Number:
Probe 4:	Frequency:	Scan Format*:	Model Number:	Serial Number:
Probe 5:	Frequency:	Scan Format*:	Model Number:	Serial Number:
Probe 6:	Frequency:	Scan Format*:	Model Number:	Serial Number:
Probe 7:	Frequency:	Scan Format*:	Model Number:	Serial Number:
Probe 8:	Frequency:	Scan Format*:	Model Number:	Serial Number:
Probe 9:	Frequency:	Scan Format*:	Model Number:	Serial Number:

* Scan Format: Phased Array, Linear Array, Curved Array, Mechanical Array or Other

FUNCTIONAL CHECKS

Functional Check (if applicable)	OK? or N/A
B-Mode Function	
Doppler Modes Function	
CF-Mode Function	
M-Mode Function	
Applicable Software Options	
Applicable Hardware Options	
Control Panel	
Monitor	
Touch Panel	
Measurement Accuracy	
GE Approved Peripherals	

PHYSICAL INSPECTION AND CLEANING

Physical Inspection and Cleaning (if applicable)	Inspect	Clean
Console		
Monitor		
Touch Panel		
Air Filter		
Probe Holders		
External I/O		
Wheels, Brakes & Swivel Locks		
Cables and Connectors		
GE Approved Peripherals (VCR, CD-R, MOD, Printers)		

COMMENTS:_____

ELECTRICAL SAFETY

Electrical Test Performed	Max Value Allowed	Value Measured	OK?	Comments
Outlet (correct ground &wiring config.)				
System Ground Continuity				
Chassis Source Leakage Current - Probe				
Chassis Source Leakage Current - Wheel				
Chassis Source Leakage Current - CRT				
Patient Lead Source Leakage (Lead to Ground)				
Patient Lead Source Leakage (Lead to Lead)				
Patient Lead Source Leakage (Isolation)				
Peripheral 1 Leakage Current				
Peripheral 1Ground Continuity				
Peripheral 2 Leakage Current				
Peripheral 2Ground Continuity				
Peripheral 3 Leakage Current				
Peripheral 3Ground Continuity				

PROBES

Probe Number (from previous page)	Max Value Allowed	Max Value Measured	OK?	Comments
Probe 1:				
Probe 2:				
Probe 3:				
Probe 4:				
Probe 5:				
Probe 6:				
Probe 7:				
Probe 8:				
Probe 9:				

Final Check. All system covers are in place. System scans with all probes as expected.

Accepted by: _____

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